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Electrical World

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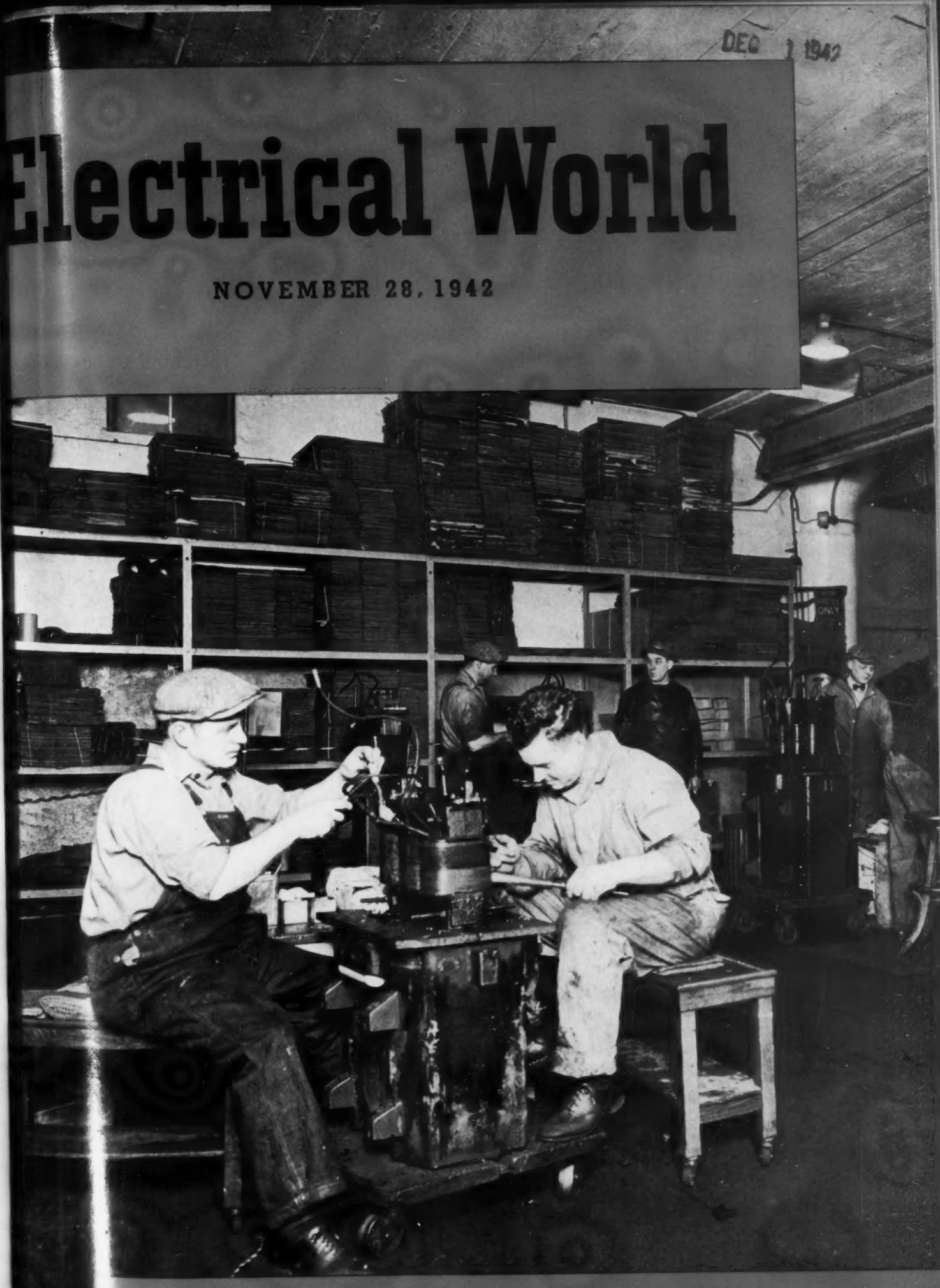

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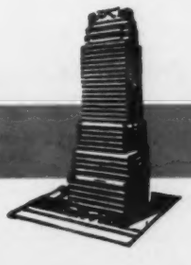

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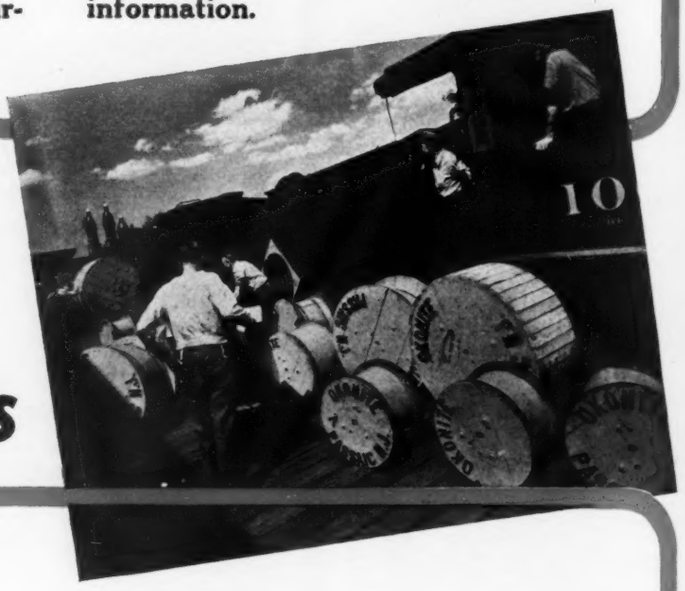

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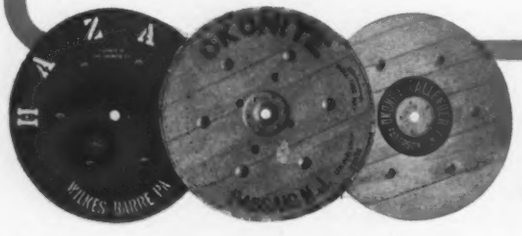

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The First Principles of Post-War Planning

There is a lot of talk today about post-war planning, but what is it? On what is it based? Is it planning for the period immediately after the war, or is it some time further into the future? Where does it start?

These are basic questions which must be answered before planning can begin. Companies that try to by-pass these fundamentals will find that what they are doing is pre-war promotion.

The longer this war continues the greater will be the economic changes and the greater the need for planning. Some of these changes, naturally, will not be fully revealed until after we settle down into peacetime pursuits. For those we cannot plan.

There are other factors, however, which are plainly evident, if not in their full extent. First, we predicate our thinking on an uninflated economy. This means no repudiation of government debt and, therefore, years of high taxes. Second, we hold to a continuance of a free economy based upon the right to earn a profit and the right to work for whomever one pleases. And, third, we believe that no life is worth fighting for unless it be one founded on progress, which to the great mass of people means a better and better standard of living.

If these premises are accepted, then we can state the problem. Even if the national income is maintained in peace at today's wartime level the net expendable by the individual will be less than before the war. This will be brought about by taxes in combination with a diminution of overtime. How are we going to improve the scale of living in the face of a lower net income per average worker?

The answer obviously lies in a larger volume of production and consumption at prices low enough to bring this about. This is the first principle. In other words, the philosophy of scarcity will not work, nor will the philosophy of paternalism and relief—only the philosophy of plenty will work.

In other words, the basis of all post-war planning must be employment, and at longer hours if necessary to get prices down to consumable levels and pay envelopes up to war levels. Who is making the plans for this? Is it management alone, or is it management and labor together? Will labor go along with management unless there is mutual confidence?

Labor doesn't want to be told by government what to do. It realizes that its only salvation lies in a continuation of the capitalistic system. But it wants a place at the table where its future is decided. It wants the place by the side of management. If denied that place we can expect it to seek protection through government. So the second principle is honest cooperation between management and labor. On these two principles rests the continuance of a free economy.

Post-war planning, therefore, is something big and broad. Its work does not start with peace, for then we merely go back to doing that which we used to do before the war. But before long the pattern of our planning will begin to emerge, and whether it be a manufacturer or a utility, or any other kind of a business organization, it will find that it can contribute to a successful peace to the degree that it acknowledges and abides by the two basic principles.

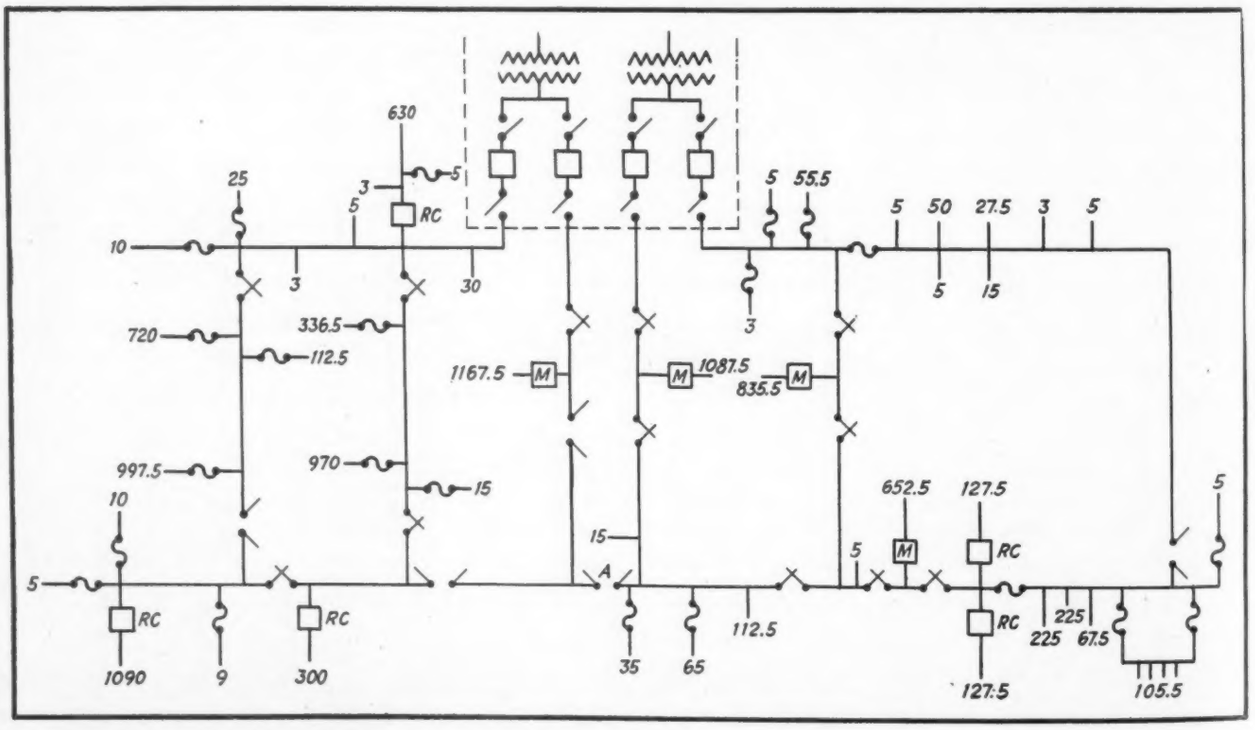
Distribution Design Under Difficult Conditions

Lack of data on the values and the characteristics of loads makes provision of electricity to large shell-loading plant a matter of inspired guessing

HAROLD A. LYNETTE, Marion, Ohio

PROBLEMS of electricity supply to munitions plant, covering a total area stated in square miles, are basically the same as in a utility distribution system. Yet there are important differences. Regulations as affecting lamp voltages is not the usual headache because lighting loads are smaller in proportion to power loads and the lighting customers, if they may be so termed, are fewer in number and less finicky about service quality. (Voltage at motors driving production equipment, however, must be maintained at a point where output will not be curtailed with operation at high demand factors at distribution centers.) Also, the techniques and the ratios of utility distribution are well established, which emphatically is not the case with distribution for shell-loading plants in this nation of peace-loving people.

These differences, coupled with the facts of wartime design and construction—restrictions on procurement of materials and apparatus, necessity for maximum speed in construction and difficulty in securing accurate information as to all production equipment and operation—present to the electrical engineer problems of which the elements are not only joined in



FOUR radial feeders routed as double loops give each load an alternate source of supply; also, a switch (A) between the pairs of feeders allows the load on any feeder to be taken by any other

Numerals state kva. of transformers connected to taps. Taps shown without fuses are for transformers close to feeders. Fused taps indicate considerable distances to transformers in the cases of small loads and numerous transformer banks serving definite production areas where large loads are shown. In some cases taps to production areas are made through manually operated oil circuit breakers (M) and to more critical loads by means of automatic reclosing breakers (RC).

unfamiliar relations but are impossible of exact quantitative statement. In which case the engineer goes right ahead and builds the system, doing the best he can with what he has. The result may not be all that can be desired in terms of economy, but the shells and bombs come pouring out of the plant. And that is the essential thing.

A Specific Plant

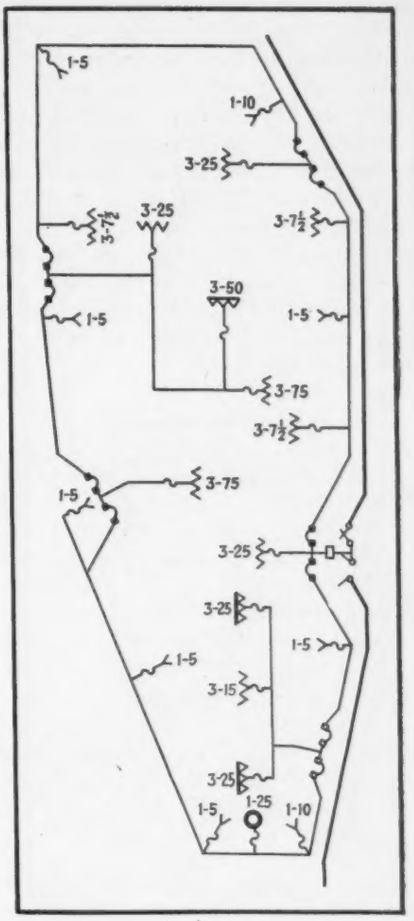
The plant whose distribution system is here described consists of about twenty fairly distinct production areas in which particular operations are simultaneously carried on. They are widely spaced, each from the other, as are also the production units in the areas themselves. With certain exceptions of compressors, pumps and some others the individual loads are small, but are subject to rapid and unexpected increases as production schedules are stepped up and production areas retooled. A primary system of 12 kv., four-wire was selected because of the long distances and the standard 120-208-volt secondary, because it allowed combining light and power service without the use of local transformers at lighting load centers. For the isolated larger motor loads a 480-volt delta secondary was used. The use of critical material in the form of copper conductors could no doubt have been reduced at the expense of simplification if 480-volt, three-wire secondary distribution had been used, but when design was selected we were not at war and restrictions on use of such materials was not as important as it has now become.

The system is a straight radial one, but the feeders and most of the primary branches are routed in loops with sectionalizing switches or cutouts so that each load has an alternate source of supply and any section may be cut clear if it gets into trouble. The distribution system is divided into roughly equal halves, each with a pair of feeders from two separate 66-kv. transformer stations. There are no 12-kv. bus ties in the substations. A normally open sectionalizing switch out on the system permits part or all of the load on one pair of feeders to be taken by the other pair. A 66-kv. tie also permits all of the 12-kv. feeders to be energized from either substation.

Each of the major production areas is served by a primary branch routed in a loop normally open on one side right at the feeder tap. Except for single-phase taps and those to some smaller three-phase banks, taps from the loop are sectionalized on each side by ordinary transformer cutouts with solid bars in place of fuses. Of course these cutouts cannot be opened under load, but by temporarily deenergizing, any section can be isolated and service then restored to the rest of the loop.

Tap Fuses

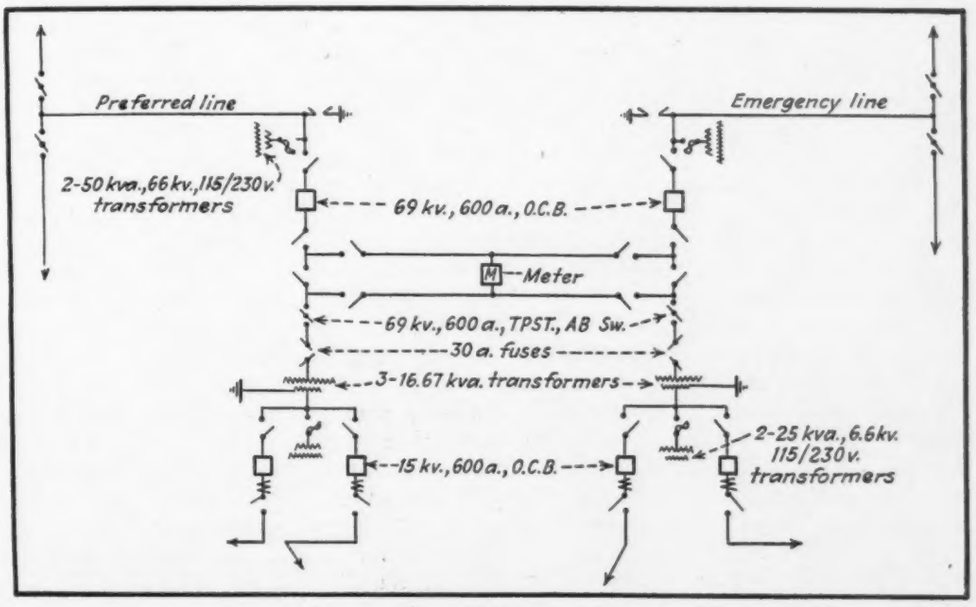
Most of the production area taps are made with high-interrupting capacity fuses. Some, at points on the system where possible short-circuit currents require, are made with hand-operated oil circuit breakers. Others, feeding important loads whose continuous operation is essential, are made with reclosing oil circuit breakers. This freedom to differentiate, allowed by the reactances of the parts of the system and by the nature of the various production operations, permitted the large use of tap fuses as shown on the diagram. No attempt was made to secure selective action of the fuses, since their function is protection against short circuit only;



DISTRIBUTION in a typical production area

Transformer symbol with heavy bar across indicates 480-volt delta secondary. Series transformer for protective lighting along fence around area is indicated by the concentric-circle symbol.

All other transformers have 120-208-volt secondaries.



ENERGY SUPPLY from two sources gives assurance of continuity

they have no responsibility in selective protection of service, as in but few cases are fuses or circuit breakers arranged in series. In these few cases the second fuse has a much smaller capacity than the first one on the main feeder tap. This use of fuses effected a very considerable saving in critical materials, and in investment.

In addition to the branches for the definite production areas, there are numerous other taps from the feeders to single transformers and to banks and groups.

Transformers

All transformers are single phase. This condition, so desirable from the standpoint of system flexibility, was made almost necessary by the fact that at the time the job was started there were little data on diversity factors, demands, power factors and other operational characteristics of distribution for the type of production operations. No comparable munitions plant from which definite data could be obtained had up to that time been in full scale production. Consequently load requirements could not be calculated with any accuracy; they had to be based on estimates that in many cases were not much better than guesses. Actually the electrical system was to be designed and installed before complete final decisions were made on types and capacities of equipment and of other production facilities in many of the production groups.

Because of several factors referred to previously and to be sure that war production would not be curtailed because of insufficient distribution capacity it was decided to size transformer stations and secondary services for the full connected load as estimated at the time of design. While this method of transformer station selection is somewhat crude and resulted in an apparent oversizing of some stations, as demonstrated, now that production provides more definite information, it has taken care of the numerous unforeseen load increases in certain areas. The stations now which appear larger than necessary are those where either production has not assumed full proportion or where preliminary load estimates were too high. The numerous changes in equipment and facilities made as design progressed and as production has got into swing required but three shifts in transformer banks. The sizing of secondary services has kept voltage drop to load centers within very reasonable limits, this being most essential, especially since for some critical drives 220-volt motors had to be substituted for the 208-volt motors ordered, as the 208-volt motors in these cases could not be furnished in time to meet the construction schedule.

Total connected load on the 120-208-volt secondaries amounts to 6,755 kva., of which 3,500 kva. is power and which is served by 338 transformers ranging in size from 3 to 75 kva. The 480-volt load totals 2,179 kva. and is served by 48 transformers of 15 to 200 kva. The entire connected load thus sums up to 8,934 kva. For this, plus 665 kva. to provide for future installation of a number of future additional compressors, there is installed 9,554.5 kva. in transformer capacity. It is expected that the maximum demand will be 4,500-5,000 kva.

This demand factor of 50 percent covers the entire project, but due to diversity between the large number of transformer banks demand factors on individual banks are much higher.

The entire primary system is overhead on Class 3, 40-ft. poles averaging 150-ft. spans. The primary neutral is grounded at every third pole and at every transformer installation. Average ground resistance is well under 0.5 ohm. Single transformers up to 50 kva. and banks of less than three 25-kva. units are mounted on poles; larger installations are on concrete slabs with wood structures protected by wire fencing. In general the primary branch lines consist of four No. 4 copper; the secondary mains of three No. 2/0 and one No. 1/0.

Secondardies

Practically all secondaries are in direct underground runs to load centers. There are few secondaries on poles except in administrative, staff residence and dormitory areas. Service connections are specified as all underground with lead-covered, rubber-insulated phase conductors and bare neutral in conduit.

In addition to the 12-kv. primary, the pole lines around the production areas carry a 6.6-amp. series circuit of No. 6 wire for protective lighting along the surrounding fences. Asymmetrical luminaries and Fresnel units with 6,000-lumen lamps are employed. The luminaires are hung 25 ft. high, directly above the fence on bracket arms mounted on the distribution system poles. The Fresnel units are mounted on the poles 12 ft. above ground, this height being determined by tests in the area. The normal 150-ft. spacing of the poles is satisfactory for the protective lighting, there being plenty of illumination overlap to avoid dark areas between luminaires.

Emergency Lighting

General and roadway lighting was not necessary throughout the plant area. Where such lighting was required by special circumstances the need was met by floodlights mounted on poles or buildings and connected to a convenient secondary. Emergency lighting was necessary for evacuation of buildings if the power supply failed. But the distances between buildings and between production areas made comprehensive emergency circuits with one or more independent power sources prohibitive in cost. The difficulty was solved by using dry cells or storage batteries with trickle chargers as sources of energy in the individual buildings. The emergency lights are standard sealed-beam units; installations of one to three units fed by dry cells and over three by storage batteries. In all hazardous areas all batteries were installed in inclosures outside the buildings with sealed conduit runs to the lights inside. In non-hazardous area the dry cell battery could be installed inside the building, the lights mounted on the battery box.

The hazardous nature of work on the main production lines required explosion-proof and dust-tight fixtures, fittings, breakers, switches and control equipment installed inside buildings. The cost and long delivery on these items made it advisable to reduce their use to a minimum. This was done by placing as much control as was possible on outside walls and away from doorways and other openings and using dust-tight or weather-proof equipment, depending on the available shelter, in place of explosion-proof equipment.

Dependable service to the munitions plant is assured by the two 66-kv. lines, a preferred and an alternate, from a large utility system. Layout of the high-voltage substation and taps from the utility lines are shown in an accompanying diagram.

Structural Steel Shapes as A. C. Conductors

Compares structural shapes in various configurations with steel and copper pipe as substitute conductors — Finds angles in "T" configuration more efficient conductor than slotted steel pipe

STANLEY C. KILLIAN and ALLAN K. ALSAKER,† Delta-Star Electric Company, Chicago*

SINCE a previous article‡ dealing with the a.c. capacity of steel pipe appeared much interest has been aroused in the possibilities of structural sections as a.c. conductors. The use of steel pipe suggests other sections and the ever-tightening restrictions on aluminum and copper make use of other conductors a patriotic as well as oftentimes a necessary measure.

To examine all steel sections for current capacity would be an endless task. Accordingly, since the angle is a very popular section, tests were made mainly with angle configurations. Other miscellaneous sections were tested to get a relationship between the efficiency of various shapes. Due to increased importance of conductor contour in ferrous sections, wide current capacity variations are found with different outlines, though cross-sections may be equal.

The test set-up was kept identical to that used previously‡ and all current values found in like manner.

*Development and research engineer.
†Assistant development engineer.
‡See article "Evaluate Steel Pipe as A.C. Conductor," S. C. Killian, "Electrical World," April 18, 1942, page 67.

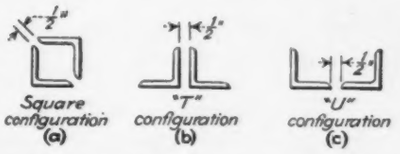


FIG. 1—Configurations of structural steel angles investigated

Readings were obtained up to 60 deg. C. rise to avoid curve extrapolation. Capacities at 30, 45 and 60 deg. rises, indoor and outdoor, are shown in the accompanying table. Angles in a "square" configuration, Fig. 1a, were found to be more efficient for like cross-section than slotted pipe.‡ Angles in a "T" configuration, Fig. 1b, showed an improvement over the square.

Basically the problem in steel a.c. conductors is the avoidance of continuous radial flux paths. In pipe the path is both continuous and radial. A slot destroys the continuity, but still preserves the radial field. The angle square introduces another gap and departs to a limited extent from the radial condition. The "T" more or less loses all symmetry and continuity. Ability to radiate, of course, is also an important factor from a temperature rise standpoint. Some tests were also made on a "U" configuration of angles, Fig. 1c. Capacities checked those of the "T" with very small variation; ¼ in. was picked as an optimum angle thickness.

Preliminary testing showed that thicker angles were less efficient as skin effect allows only a small depth of current penetration in ferrous conductors. Sections thinner than ¼ in. are usually impractical from a mechanical strength standpoint. All tests were made with galvanized sections. Values shown in table are also applicable to aluminum painted sections. Approximately 15 percent can be added when the conductor is well weathered or covered with a paint of good emissivity. The average d.c. conductivity of the sections tested was 13 percent, as compared to 100 percent conductivity copper. A.c. conductivity is discussed later.

When operating steel conductors at 45 and 60 deg. C. rises care should be taken to prevent heat transfer from bus to other equipment rated at 30

Current-Carrying Capacities of Structural Steel Angles in Amperes at 30, 45, 60 Deg. C. Rise, 60 Cycles

Angle Size In Inches	Cross-section Sq. Inches (2 Angles)	Square Configuration, Fig. 1 (a)						"T" Configuration, Fig. 1 (b)					
		Indoor Rise °C.			Outdoor Rise °C.			Indoor Rise °C.			Outdoor Rise °C.		
		30°	45°	60°	30°	45°	60°	30°	45°	60°	30°	45°	60°
1½ x 1½ x ¼	1.38	270	360	445	340	450	560	280	370	460	350	460	570
2 x 2 x ¼	1.88	350	465	575	440	580	720	375	500	615	470	620	770
2½ x 2½ x ¼	2.38	430	570	705	540	710	880	470	625	770	590	780	960
3 x 3 x ¼	2.88	505	670	830	630	840	1,040	565	750	925	710	940	1,150
3½ x 3½ x ¼	3.38	575	765	945	720	960	1,180	660	875	1,080	820	1,090	1,340
4 x 4 x ¼	3.88	635	850	1,40	800	1,060	1,300	750	995	1,230	930	1,240	1,530

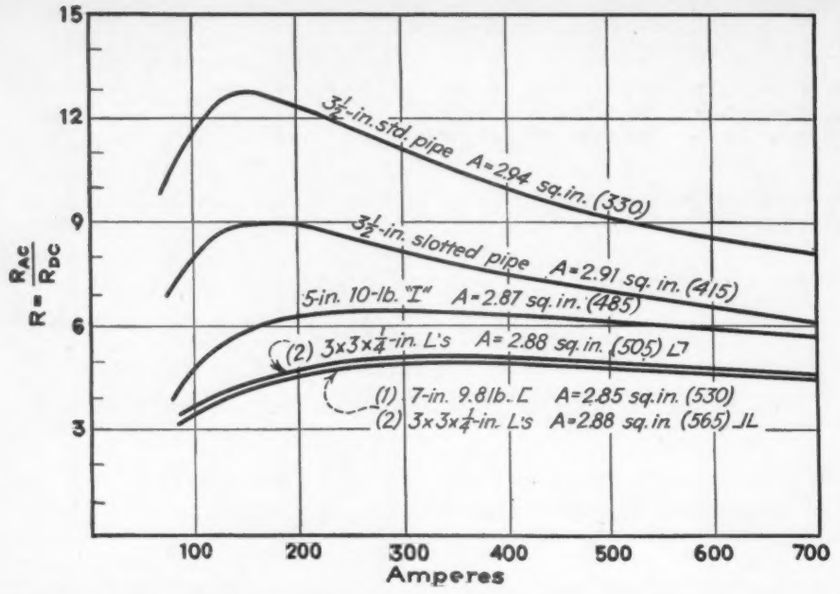


FIG. 2—Ratio a.c. to d.c. resistance varies widely for different configurations of structural steel and steel pipe conductors. Numbers in parentheses indicate indoor 30 deg. rise capacity

deg. C. maximum rise. For example, it would be poor practice to connect a bus with 60-deg. rise directly to switch lug. Enough heat would transfer to raise switch above 30 deg. rise. One method of overcoming this objection would be to use a short overrated copper section between steel bus and switch. Brazed or soldered joints between steel and copper are desirable to prevent oxidation of copper at elevated temperatures.

Miscellaneous Sections

Various size beams were tested and capacities were found to be 10 to 15 percent less than angles in "T" configuration having same cross-section. Tests were made with the beam web vertical. Indoor 30 deg. capacity for a 5-in., 10.0-lb. I beam is 485 amp., while two 3 x 3 x ¼-in. angles, same cross-section, will carry 565 amp. Indoor 30 deg. capacity for a 6-in., 12.0-lb. H-beam, cross-section 3.53 sq.in., is 620 amp.; for an 8-in., 17.0-lb. H-beam, cross-section 5.00 sq.in., 850 amp. Indoor and outdoor capacities of these beams for other rises can be calculated by applying similar ratios, which can be obtained from the table.

A 7-in., 9.8-lb. channel, area 2.85 sq.in., web vertical, has an indoor 30 deg. capacity of 530 amp. and a 4-in., 6.25-lb. channel, area 1.82 sq.in., 330 amp. Although better than beams on a cross-section basis, channels are poorer than angles in "T" configuration. The advantage of mechanical strength that beams and channels have over angles is offset by lower capacity and, in some cases, by the more bulky connections necessary for splices and tap-offs.

All beams and channels mentioned above have ¼-in. webs. Check tests showed that sections with less than ¼-in. webs have a somewhat higher capacity per square inch.

Two 4 x 3 x ¼-in. angles in "T," 4 in. leg vertical, had capacities somewhat less than the same arrangement of 3½ x 3½ x ¼-in. angles, although both configurations have the same cross-section.

Steel bars as conductors have the following disadvantages: Thick sections must be avoided; thin sections have low capacity because of size, and skin effect lowers the capacity of multiple thin bars. A single vertical ¼ x 4-in. bar has an indoor 30 deg. capacity of 210 amp., a single vertical ⅜ x 6-in. bar 330 amp.

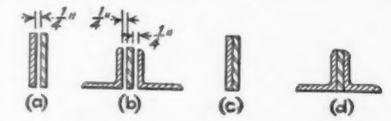


FIG. 3—Combinations of copper and steel sections have lower carrying capacity than copper element alone

Thickness in angles is undesirable also. A 3 x 3 x ⅜-in. angle, area 2.11 sq.in., has an indoor 30 deg. capacity of 290 amp. and is less efficient than the above ⅜ x 6-in. bar, area 2.25. Single ¼-in. thick angles were tested and have capacities approximately half of the corresponding angle pair in "T" configuration. A single 3 x 3 x ¼-in. angle, 280 amp., has almost the capacity of a 3 x 3 x ⅜-in. angle.

A.C to D.C. Resistance Ratio

As mentioned before, skin effect, continuity of flux path and contour are main factors to be considered in ferrous conductors. Tests were made to determine conductivity efficiency of various shapes, all of approximately the same cross-section. Results are shown in Fig. 2. The ratio of a.c. resistance to d.c. resistance is represented by *R*.

The a.c. resistance was found by making a single-phase set-up and taking readings on a section of conductor. Voltage drop, current and wattmeter power were recorded. These values were translated into impedance, power factor and resistance. Curves in Fig. 2 are based on 25-in. conductor spacing. Check tests were made at 12½ in. and 50 in. spacing and variations were shown to be very small. Therefore, for average accuracy, the curves can be considered as applying to an isolated conductor.

Note that the resistance curves predict the current-carrying capacity of the various sections. The ability to radiate, a factor not included in the effective resistance readings, also influences the carrying capacity and accounts for small discrepancies between the two test procedures. Angles in "T" configuration and the channel showed almost coinciding results and only one curve is shown for the two sections. The capacities of the sections are noted for ready comparison.

All curves follow the familiar μ-H pattern, the ratio increasing due to increased permeability as current is raised and then decreasing due to saturation, as current is further increased. While the 30 deg. rise capacities are well beyond the curve peaks, it is interesting to find that the a.c. resistance of iron pipe could be as high as thirteen times the d.c. resistance. Angles in "T" and channels show a maximum a.c. to d.c. ratio of only five.

Galvanized sections were used for all these tests. The use of ungalvanized sections results in a considerably higher a.c. to d.c. resistance ratio.

Paralleling copper and steel sections to increase conductor capacity sounds feasible, but is likely to be misleading. The indoor 30 deg. capacity of a single ¼x4-in. steel bar is 210 amp.; of a like copper bar, 1,250 amp., but when paralleled as shown in Fig. 3a the combination is good for only 1,070 amp., with the steel carrying only 10 percent of the current and the copper having the 30 deg. rise.

In an effort to cause the steel part of a combination to carry more current a test was run using two 3x3x¼-in. angles in "T" configuration with a ¼x3-in. copper bar between vertical legs, Fig. 3b. This combination has an indoor 30 deg. capacity of 930 amp.; while alone, the steel angles will carry 565 and the copper bar 950. The copper angle had the 30 deg. limiting rise.

Skin effect in the copper due to a medium of high permeability next to it is greatly intensified. Due to this effect the loss of usable current-carrying copper more than offsets the addition of steel as a parallel conductor.

Tests were also made with arrangements shown in Figs. 3c and 3d, using the same conductors as Figs. 3a and 3b. Members were bolted together at 2-ft. intervals. The steel acts as a heat absorber for the copper, but magnetic heating in the steel and skin effect in the copper are increased. These two factors more than overcome the heat absorption gain, resulting in lower capacities when compared to Figs. 3a and 3b.

Capacity Released by Load Swing Control

Frequency trend is index of generating capacity additions or deductions to carry stable system load — Refined frequency indication and improved dispatching make system capacity more effective

J. E. McCORMACK, Assistant Outside Plant Engineer Consolidated Edison Company of New York, Inc.

LOAD SWINGS on an interconnected system can too readily be accepted as a necessary evil limiting the effective capacity of the interconnection. In so far as these load swings are of general experience they act as a brake on the full realization of the capacity available for war output.

Much of this sacrifice has been averted on the system of the Consolidated Edison Company of New York by adopting a method of system operation using frequency as a control when making manual load changes on generating units.

Tie lines installed with primary regard to thermal and stability limitations may present an additional operating limitation when power is transferred because it may prove necessary to hold the average loading well below the maximum in order to remain within safe operating limits during load swings. In certain cases as much as 20 percent of the rating of existing tie lines was unavailable because of the need to allow for the swings.

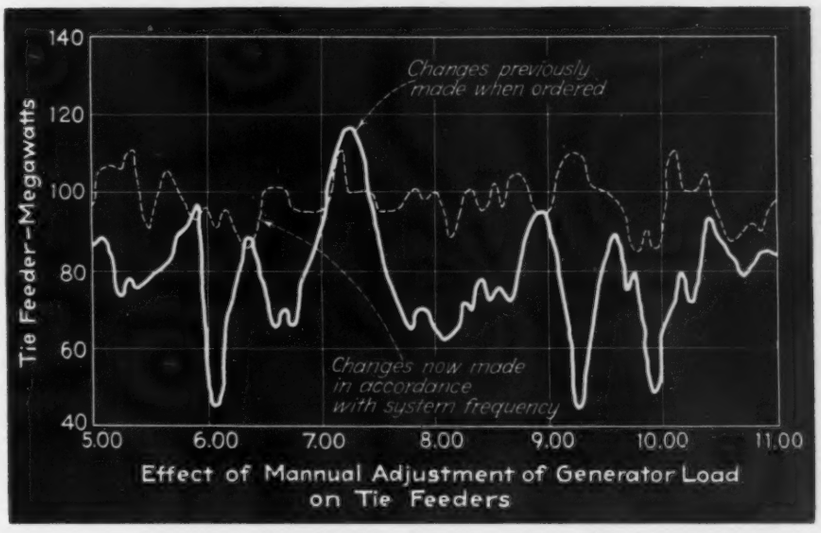


FIG. 1—Effect of manual adjustment of generator load on tie feeders

If the load swings on tie feeders are not reduced it will be necessary to design new tie lines as much as 20 percent higher than the required transfer capacity. In addition to reduction in effective utilization, load swings also have an adverse effect on economy and operation by decreasing boiler efficiency, disrupting load schedules, increasing fuel losses and adding to maintenance costs. All these factors have significance in connec-

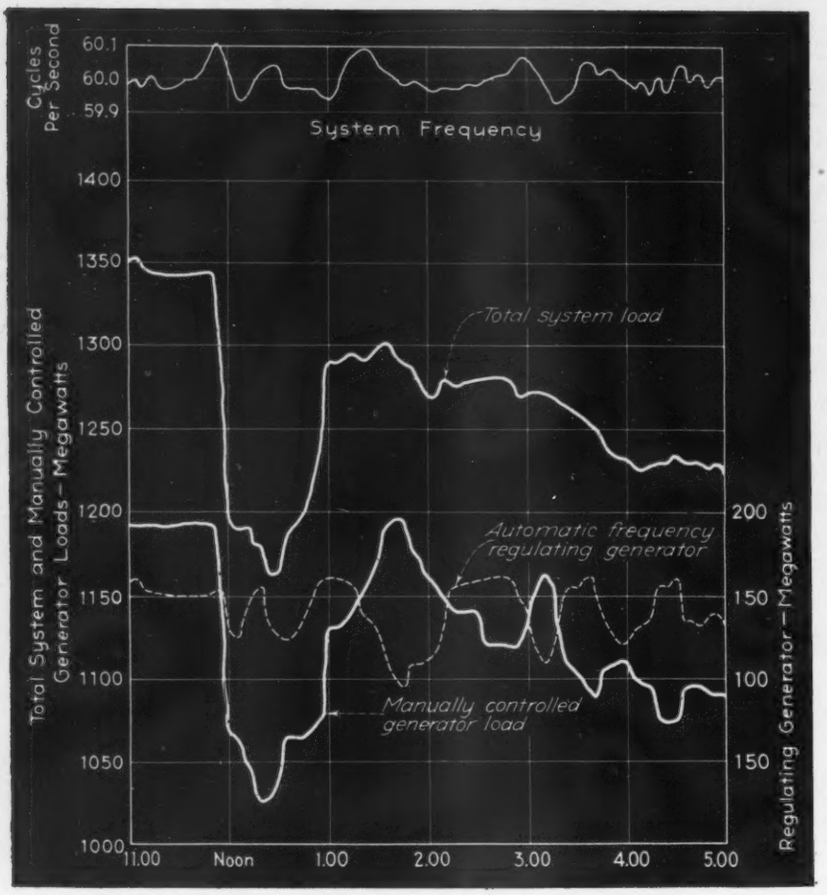


FIG. 2—Load swings caused by ordered load changes

tion with maximum availability and utilization of generating capacity in war areas.

Manual Adjustments Cause Swings

Analysis of a series of tests made by the Consolidated Edison Company of New York yielded the following pertinent results:

1. Although a change in voltage results in a corresponding change in system load, a change in system frequency within operating limits does not make an appreciable change in system load.

2. Load swings on generators and tie feeders caused by system load are negligible. All major load swings are caused by manual adjustments of the governor valves in one or more stations during load change periods. Governors, frequency controllers and associated control equipment do not contribute to load swings, but act to limit them.

Load-dispatching methods were modified as a result of these conclusions. After a short trial period it was found possible to reduce the load swings to negligible values and it is now possible to load the tie feeders to their maximum rating continuously.

A typical before and after load curve (Fig. 1) shows the improvement realized shortly after putting the method in effect. These load transfer gains in kilowatt-hours per hour have been as much as 20 percent.

Frequency and Voltage Effects

A portion of the system having a load of about 375,000 kw. was isolated from the remainder of the system and a series of tests made to determine the effect on the system load of a change in the voltage or a change in frequency.

The following results were obtained:

1. A reduction in bus voltage with the frequency held constant resulted in a reduction in real and reactive load. A decrease of 10 percent in voltage resulted in a reduction of 13 percent in real load and 17 percent in reactive load.

2. A change in frequency with constant bus voltage will not result in an appreciable change in load. A 3 percent change in frequency resulted in no noticeable load change.

It is practically impossible to estimate the effect of the system frequency on the load because the system load is a composite of several types. Motor load will vary with the frequency, but lighting load will not be affected by the frequency. However, the average utilization voltage may be slightly higher at lower frequencies because of the lower reactance to the load point. Consequently, the lighting load might vary inversely with the frequency because of the variation in utilization voltage. Iron losses will vary inversely as the frequency.

From the results of our tests it is evident that these various factors balance each other out.

Manual Cause of Load Swings

Additional tests on the turbine governing equipment led to the following conclusions in reference to load swings:

1. Load swings originating in the system load such as railroad and rapid transit fluctuations are distributed in proportion to station capacities and amount to less than 3 percent of the station capacity.

2. Governors do not contribute to load swings, but act continuously to maintain frequency within an 0.15 to 0.20 cycle band.

3. Large load swings which affect the operation of tie feeders, generators, boilers and associated equipment are caused by manual operation of governor valves in one or more stations during periods of load change.

The tests definitely indicate that the load swings affecting capacity are created when the generated load is changed manually at the stations. These load swings are caused by increasing the station output when the system frequency is already high or lowering the station output when the system frequency is low. Since the system frequency is the one measureable quantity common to all stations, it provides an excellent index to the station operators as to whether or not it is desirable to increase or decrease the output of their station. *Using the system frequency as a guide load swings can be materially reduced if the station operators increase the*

output of their stations only with low or dropping frequency and decrease the output only with high or rising frequency.

In order to follow this rule it was necessary to make some changes in our load-dispatching routines. It had been the practice for the system operator to make an advanced estimate of the load requirements based on past experience with the hour-to-hour changes in system demand. Small blocks of load were then assigned to each station on the basis of the estimate. The station operators made these changes on receipt of orders from the system operator, with no regard to the system frequency at the moment of making the change. If the system demand did not change exactly as anticipated the ordered change would cause the frequency to depart from normal, resulting in a system-wide load swing as the automatic governors and controllers operated to compensate for the excessive change. An example of such a load swing is shown in Fig. 2.

The system operator now makes the same estimate of the load requirements as before, but assigns the load change to each station in *larger blocks and less frequently*. The station operator makes the load change only when the change will tend to restore the frequency to normal. In other words the station operator increases his generation only with low or dropping frequency and decreases it with high or rising frequency. In this way errors in load anticipation are automatically prevented from causing load swings which cut down the effective capacity of the tie feeders.

Accurate Frequency Indication

Need for accurate frequency indication in each station became immediately apparent. The ideal arrangement would be for each station to have the same frequency indication. If this were to be done with separate instruments it would require an accuracy of about one part in 50,000, which is beyond the realm of ordinary indicating instruments. One method would be to have a centrally located frequency instrument which sends a signal to all stations simultaneously. Another method would be to transmit a standard frequency voltage and compare it differentially at each station with voltage at system frequency.

The second method was adopted for use in New York City, using a standard frequency accurate to better than one part in a million. This standard frequency voltage is transmitted to each generating station and compared with a system frequency voltage by means of a differential motor. The direction of rotation indicates whether the frequency is high or low and the rate of rotation is a measure of the amount of departure from standard frequency. This method was practical in New York City because of the few relatively large stations and the short distances between them. In order to use this scheme over a more widespread system we have developed a frequency indicator (Fig. 3) operated from a frequency standard received by radio.

New Frequency Indicator

Radio signal is amplified by a radio receiver at each station and the amplified standard frequency voltage output is impressed on a step-up transformer. The transformer supplies a neon tube which is circular in shape and is covered by a disk having a single slot. The disk is driven by a synchronous motor from the power system. The standard frequency in cycles per second must be exactly divisible by the motor synchronous speed in revolutions per second. When the device is in operation the neon tube is viewed through the slotted disk and a series of light spots evenly spaced in a circle will be seen. If these spots remain stationary the system frequency is correct. If the spots appear to rotate the system frequency is above or below the objective value, depending on the direction of rotation of the light spots.

A few trial installations of this device are in service using an existing frequency standard broadcast by the Bureau of Standards in Washington. This signal is broadcast on a carrier frequency of 5 megacycles modulated by a 440-cycle tone. A 1,200-r.p.m. synchronous motor is used to drive the disk. Experience with this device has been satisfactory, but has been limited by insufficient signal strength from a temporary transmitter which takes the place of one that was damaged by fire. The damaged transmitter is being rebuilt and is expected to be placed in service shortly with sufficient signal strength to cover the country.

Automatic Frequency Control

This method of controlling manual adjustments does not supplant automatic frequency control which handles the small variations in frequency normally present because of the small changes inherent in the system load. However, the frequency controller does not regulate as much as before because it does not have to compensate for the unnecessary changes made by the station operators.

One feature that cannot be overemphasized is the necessity for presenting the problems involved in load swings to all of the station operators in order that they may have a clear picture of the limitations that load swings impose on a system. One satisfactory method has been the selection of a load swing that has caused some system difficulty and presenting a graphic analysis of all the factors involved showing the cause of the load swing, together with suggestions for preventing a recurrence of a similar trouble.

This method has been found to be extremely satisfactory in reducing our load swing problem to a negligible value.

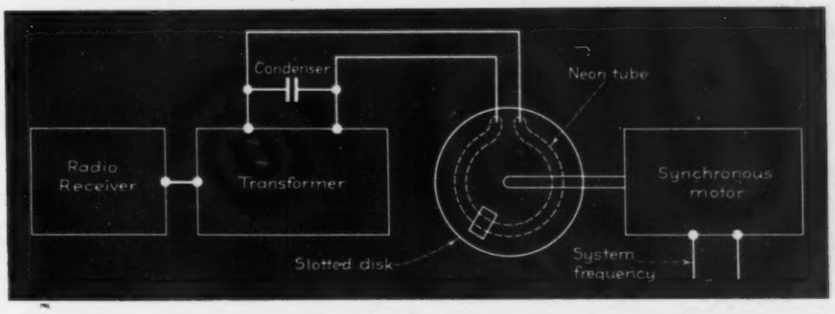
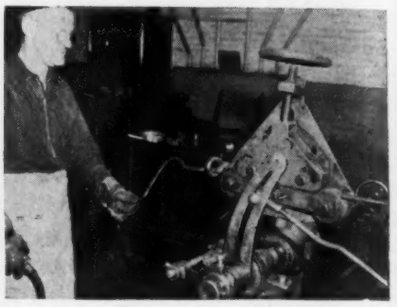


FIG. 3—Stroboscopic frequency indicator using a radio broadcast standard frequency

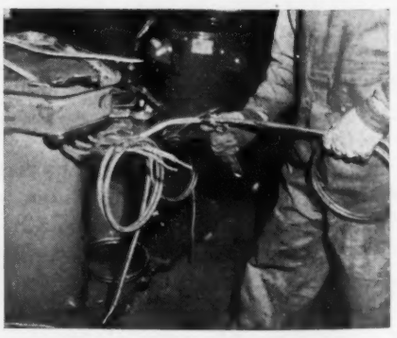
Salvaging and Reconditioning

RESTORES WIRE INSULATION—Salvaged weatherproof wire on which braid is intact but from which compound has been lost is dipped in Rubberoid, rapid asphalt paint, No. 2 to restore the compound. The two-compartment dipping tank, with a capacity of ten 100-lb. coils, is shown being loaded. Wire dipping compound is received in the form of black varnish, which is diluted to a thin consistency, using olium spirits (minimum flash point 100 deg.). Because of the explosive properties of the compound the mixture is stored in an underground tank and dipping is done out of doors. With the tank loaded, enough cold compound is pumped into the tank to cover the coils, which are allowed to soak for five minutes. At the end of that period the tank is drained and warm air from a unit heater circulated through the tanks for three or four hours before the coils are removed. Treated in this manner turns in the coils will not stick together and the wire is ready to be returned to service. Wire is spliced into continuous coils before dipping using a short tubular compression sleeve of original design which is threaded on the inside to provide necessary gripping action. Joints are covered with friction tape.

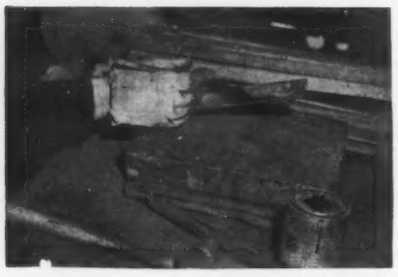


WIRE STRAIGHTENER—Straightener is mounted on the transverse mechanism of a commercial reeling machine. Wire to be straightened is drawn between five staggered grooved rolls to remove kinks. The handwheel adjustment permits clearance between the staggered straightening rolls to be varied to suit the size of wire being run through.

RECONDITIONING MACHINE BOLTS—For running nuts on salvaged machine bolts and other threaded pole line hardware there is used a light portable electric drill fitted with an attachment consisting of a hollow tubular ferrule and square socket into which the nut and bolt assembly is thrust. This adapter idles until a bolt is thrust against it, engaging a simple jaw clutch that turns the fitting either to remove the nut or to run it on, depending on the direction in which the reversible drill motor is turning. When threads are badly jammed a split threading die is run over the bolt to straighten them. In the past the company has been spray-galvanizing bolts and other salvaged hardware of similar type. With the impending shortage of zinc, however, the company is experimenting with the use of a low tin content lead alloy coating which has just sufficient tin (8 to 10 percent) to allow it to flow freely when hot. This treatment is not yet accepted as a standard treatment by the salvage department. In applying the coating, bolts are first "pickled" to remove galvanize and rust, then given a flux coat, dipped into the hot lead bath and spun to remove excess material. Resulting coating is 0.0015 to 0.002 in. thick.

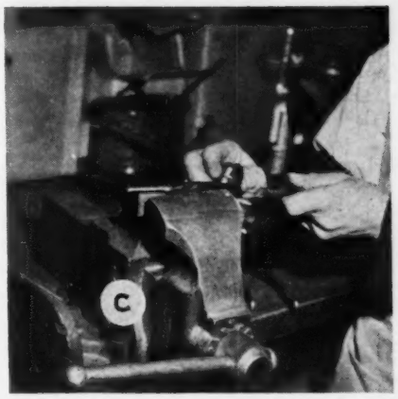


USING UP WIRE ENDS—Short lengths of weatherproof wire not long enough to be spliced economically are attached to transformer leads and used as trainers. Connection of trainers to leads in the shop reduces the amount of cutting and fitting required by linemen on the job. It also provides an excellent outlet for odd lengths of new wire on the "tag" ends of reels. Trainers are usually 6 to 8 ft. in length.



GALVANIZING "TOUCHED UP"—Small breaks in the galvanizing on salvaged crossarm braces, switch pantographs and similar types of line hardware are cleaned with a wire brush and exposed base metal "touched up" with a lead base paint of the "Subox" type. Crossarm braces are straightened before treatment, using a lead block anvil.

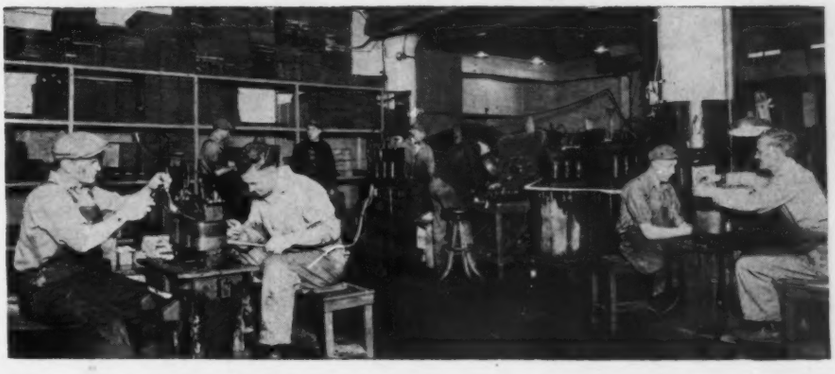
on the Detroit Edison System



CONNECTOR RECLAMATION—Reclaiming of mechanical connectors has been reduced to a relatively simple routine. To remove tape, batches of connectors which have been cut from line conductors are lowered into a tri-chloro-ethylene ($CHCL:CCI_2$) vapor degreaser and left for one to two hours (a). "Soaking" time can be shortened to 15 or 20 minutes if essential by slushing in the liquid solvent. Solvent vapor removes adhesive properties of the tape and allows it to be unwound easily. Denuded connectors are next put in a tumbler with sodium acid phosphate solution (Oakite 31) to remove tar residues and brighten the surfaces. Individual connectors are then inspected individually, and where not too badly bent legs are straightened, using a square-shank gage of the proper dimensions; jammed threads are straightened with a small triangular file until nuts run freely (b). Holding beads are disposed of. A small amount of filing on the inside of the connector legs is often helpful when legs are bent, to give clearance between the nut spacer and the connector legs. Straight line splices are cleaned by brushing outside with kerosene or "Stanisol." They should not be dipped since chemicals will damage steel spring assembly. Wire ends are removed with thin metal spiral that enters between wire and connector shell and retards gripping jaws (c). Tool is supplied by manufacturer for this purpose.

INSULATORS CLEANED — For cleaning glass and porcelain line insulators coated with a film of either dirt or cement dust a bath of mild alkaline type known as Wyandotte G metal cleaner is used. It is maintained at a temperature of about 150 deg. by electric immersion heaters. Insulators are soaked in this solution overnight or for a minimum of two to three hours, depending on the amount of dirt present. They are then removed and wiped dry. It is warned that the insulators must be wiped, since the solution will not remove deposited dirt, but only loosens it. The company has found that cement-coated insulators can be effectively cleaned with this solution; however, a longer than ordinary soaking time is required and the insulators must be wiped vigorously. The solution may etch away some of the zinc coating on insulator caps and hardware unless steps are taken to prevent it. The tank used is not under thermostatic control. Only enough heating capacity is provided to bring the solution to temperature and replace losses.

RECONNECT TO SINGLE PHASE—Due to a change in the three-phase commercial power rate, Detroit Edison Company has for some time been removing from service three-phase, three-wire distribution transformers which could not be reconnected for four-wire. In order to make these transformers available for other uses they are being reconnected for single-phase service. These units, of which upward of 2,000 have been handled to date, were formerly star-connected on the primary side, delta on the secondary side. In reconnecting them for single-phase service one leg of both primary and secondary windings was shorted out. Turns in the primary side of the remaining coils were reduced in number to allow connection in series to give the proper voltage ratio. Secondary coils were connected in parallel, making the reconnected transformer suitable for two-wire, 220/4,800-volt power service. As reclaimed in this manner the transformers are now used on small power installations with 80 percent of their former rated capacity.

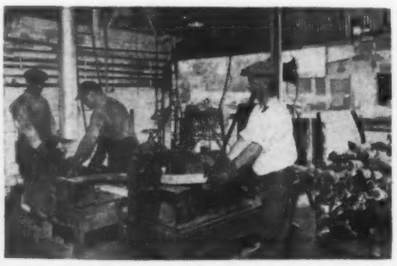


SOLDER SALVAGE—Salvaged cable joints from which wipe metal is to be reclaimed are split open with an air hammer, racked in a thermostatically controlled electric oven operating at 400 deg. F. After filling compound has been melted out copper conductors and sleeves within are salvaged. Wipe metal is trimmed off using the alligator shear shown and the remaining lead sheath melted down and cast into pigs for sale. Wipe metal is melted, analyzed for tin content and additional tin added to bring the mix to specifications. It is then cast into bars and pigs for reuse. The melting furnace used has a 2½-ton capacity and burns a mixture of old transil oil and automobile crank case lubricant supplied from used-oil storage.

REPAIRING STREET LIGHT STANDARDS—Cracked and broken street light fixtures of cast iron are rebuilt by electric welding, except in cases where the base is severely shattered. Coated "copper arc" welding rod is used in the electrode holder with "Everdur" rod fed into the arc zone simultaneously to act as filler and impart sufficient strength to the weld. Use of the

two rods simultaneously is said to obviate the need for heat treating the weld following the repair.

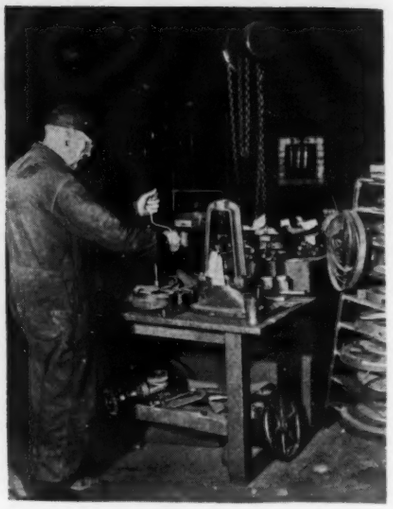
REMOVING CABLE SHEATH—Lead sheath cable received from the field in about 6-ft. lengths is passed lengthwise between power-driven knives which split the sheath



into two equal parts, allowing removal of conductors and insulation. Basically the sheath slitter, designed and built in the company shops, consists of two positively driven concave rolls, each fitted in the center with a knife disk. Studs on the face of each roll penetrate the sheath and draw it through the machine. Top roll of the slitter can be moved up or down with respect to the other, permitting a wide range of cable sizes to be run through the machine. Cable passes through the machine at the rate of 2-3 ft. per second.

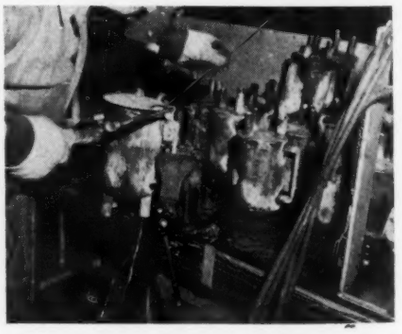
←

RECLAIMING STREET LAMP REFLECTORS—When the enameled reflecting surface of street light units are only slightly chipped, exposed metal is cleaned and painted with a priming coat. The entire reflecting surface is then sprayed with a white enamel paint. In severe cases the entire reflector is shot blasted and sent out to a local firm for re-enameling.



VALVES RECONDITIONED—Mechanical as well as electrical equipment and materials are reconditioned by the Detroit Edison Company in its comprehensive salvage operations. Here valve seats and disks are being dressed with emery cloth and lapping compound, using both hand and power tools. A rack of the various size fixtures required for the sizes commonly encountered is shown at the right. After being dressed, tightness of valve seats and body castings are checked by water pressure. Major repairs such as replacement of seats and disks may be done by valve manufacturer.

REBUILDING STREET LAMP TRANSFORMERS—While it is not a highly remunerative operation, the rebuilding of IL-type street light safety coils or transformers does conserve essential material. Bottom of the coil case (usually rusted) is cut out with an acetylene torch and the coil removed. Both coil and can are placed in a vapor degreaser, where compound is removed. After the coil has been rewound it is replaced in the can, which is again filled with compound, and a new bottom welded in



place as shown. During the rebuild a scrap-iron mounting bracket is added to the side of the case so that the coil may be either hung upside down on a crossarm or used in the base of bright-way units. Those units used in the base of street light fixtures are coated with bitumastic compound and set on circular rests made from old crossarm braces, to keep them off damp concrete and prevent rust.

Transformer Upkeep for REA Cooperatives

L. C. GROAT, Spoon River Electric Cooperative, Inc.*

TRANSFORMER maintenance is a problem which, for REA Cooperatives, has only recently begun to assume a role of major importance. Most cooperatives have been in operation only a few years and the new transformers installed have required very little maintenance up to this time. However, they have now had opportunity to accumulate moisture. This moisture, in conjunction with the slightly acid content of some oils, may have formed sludge and oxidations. These can now be causing difficulty in the normal cooling of these transformers, by interfering with the circulation of the oil through its natural channels within the transformer windings and in the case of the larger transformers through the radiating device with which the transformers are equipped.

Technique is available to remove these hazards to transformer operation so that the loads can be carried safely. In nearly all cases the filtering process we have adopted can be carried on with the transformers in service and energized.

Smaller type of filtering equipment was found low enough in cost so that the expenditure for this equipment was well justified as insurance. Spoon River Electric Cooperative, Inc., has recently purchased Westinghouse oil-filtering equipment of the type designated "B-5" and Westinghouse portable oil test equipment. With this equipment the cooperative has reconditioned the oil in all substation transformers in service on its lines.

In doing this work we found that in order to remove the final trace of moisture and bring the break-down test of the oil above 25,000 volts it was necessary that some sort of heating device be used to thoroughly and completely dry the filter paper. Ordinary heating units installed in an old kerosene-stove oven did not seem to produce satisfactory results. Later, two 250-watt infra-red lamps were mounted underneath the oven. These infra-red lamps seem to remove the last trace of moisture from the filter paper and produce the tinder-dry condition so necessary for the finishing up of our filtering process.

Frequency of filtering operations depends on many variable items, the more important of which are:

1. The type of vent arrangement on the particular transformer.
2. The kind of oil with which the transformer was originally filled.
3. The location of the transformer and the degree of temperature variation to which it is subjected.
4. Atmospheric conditions at point of installation.
5. Loading and load variation.

The safe plan is to take samples from the transformers at each substation annually and have these samples tested for condition of the oil. However, considerable care must be exercised in taking these samples. Usually there is a quantity of oil which lies in the pipe and valve in the bottom of the transformer where the sample would be taken. That oil does not circulate and it would not give a true indication of the character of the circulating oil within the transformer. It is necessary to draw off a small quantity (usually a half pint to a pint is sufficient) before taking the sample which is to be tested.

Some difficulty was experienced in securing suitable material for connecting the filtering equipment with the transformers to be filtered. However, this was solved by the use of solvents hose, which is made of a synthetic rubber unaffected by oil.

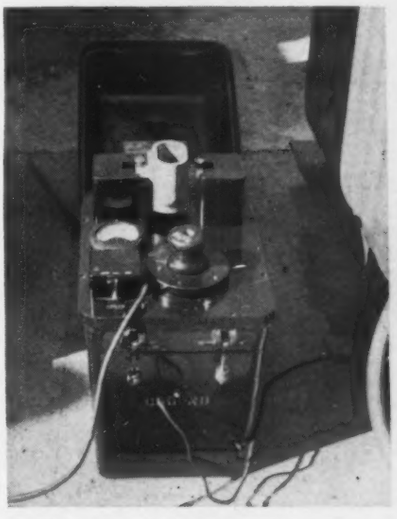
Spoon River Electric Cooperative, Inc., is making this filtering equipment and testing equipment available to other cooperatives in the state of Illinois on a rental basis.

*Manager, Lewistown, Ill.

OIL-FILTERING equipment frequently applied to energized transformer

The author stands behind the apparatus. It takes about three to five hours to filter the oil in a 250-kva. transformer, depending on the condition of the oil.

OVEN for drying filter papers (hung on the rods projecting from the back) is heated by the two 250-watt infra-red lamps supported underneath

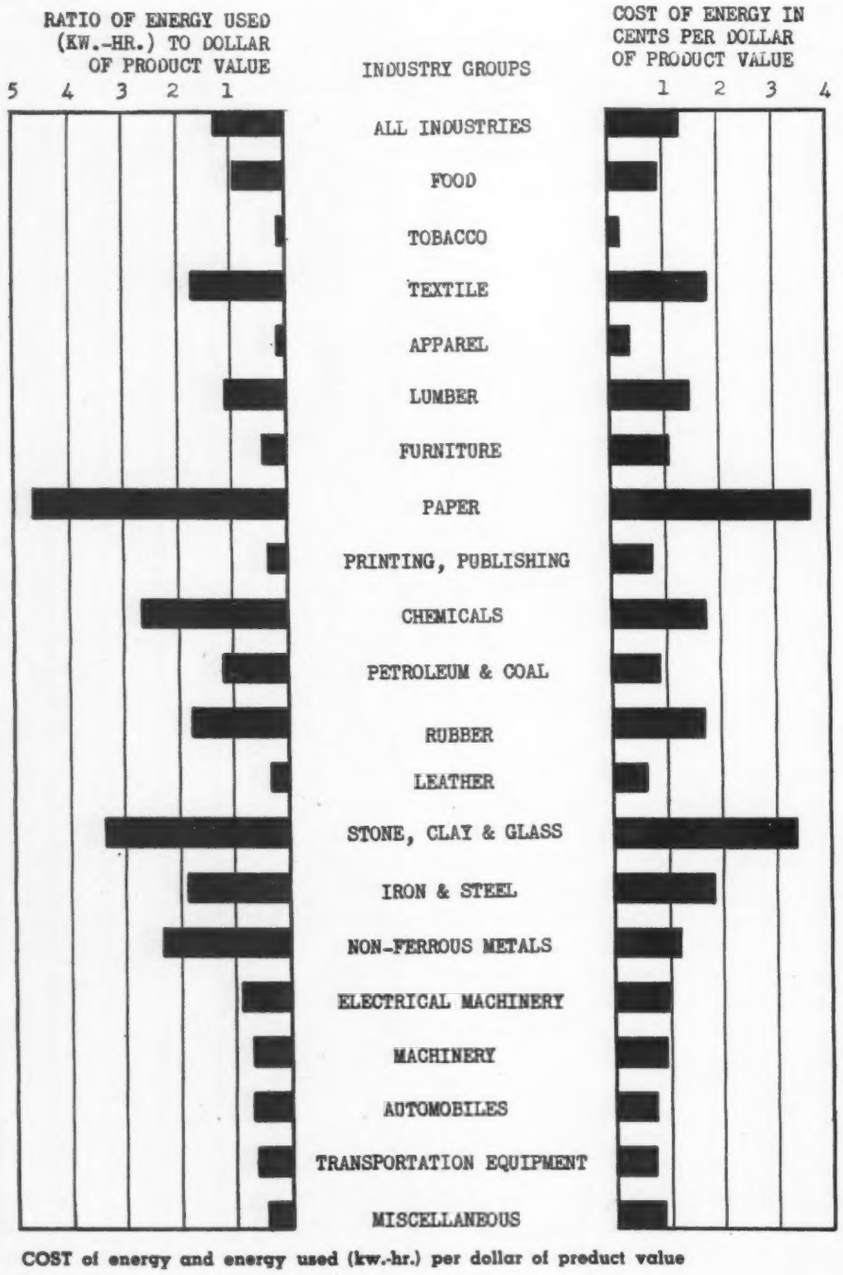


PORTABLE oil test equipment

Simple to use: Sample can be taken and tested in five to ten minutes. Frequent tests are made during a filtering operation to indicate progress.

Electricity a Small Item in Industry's Costs

Analysis of the 1939 Census figures shows ratios of electricity used and of costs of electricity per dollar of product value, also the energy used per wage earner



COST of energy and energy used (kw.-hr.) per dollar of product value

FOR EVERY DOLLAR of value of products from manufacturing industry in the United States 1.25 kw.-hr. of electric energy is used. In the various industries the quantities used range from a low of 0.09 kw.-hr. in tobacco manufacturing to a high of 4.65 kw.-hr. in paper and allied goods production. For the dollar of product value the cost of electricity, as accurately as it can be determined, is 1.28 cents and it ranges from 0.14 cent to 3.67 cents with the same industries at the low and high points. These ratios are derived from the 1939 Census of Manufactures, parts of which are being published in pamphlet form by the Bureau of the Census.

The figures of electricity used per wage earner are revelatory of the characters of manufacturing processes. Apparel manufacture, an assembly operation on light-weight materials including much manual work, uses only 470 kw.-hr. per worker per year, while paper, a heavy manufacturing operation, uses the most electricity per worker, 35,483 kw.-hr. annually.

There are several things to be kept in mind in examining the ratios presented in the accompanying tabulation. One is that they are of manufacturing industries only. Extraction and reduction industries are not included. For instance, the group, "Non-Ferrous Metals and Their Products," in which is comprised the making of aluminum, magnesium and other light metal goods, does not include the extraction of those metals from the states of their natural occurrence. Another is that the figures of kilowatt-hours of electricity do not state entirely the total use of power.

Horsepower per 100 Wage Earners

	1899	1909	1919	1929	1939
In Electric Motors	11	73	183	404	576
In Total Power	207	288	337	491	642
In Purchased Power	4	27	106	260	371

There is still in American industry a very considerable employment of mechanical power which is difficult, rather is impossible, of integration in terms of energy used.

This difficulty is responsible for a defect in the interesting table of "Horsepower per 100 Wage Earners." The row of figures of "In Total Power" is a row of hybrids. These figures are the sums of horsepowers of motors driven by purchased power and the horsepowers of prime movers in the industrial plants. Really these two quantities are not capable of addition because they are different things. It is like adding roller skates and duck eggs. But the total is the closest approximation to the true condition that can be reached and it stands, simply on the proposition that any statistic is better than no statistic.

The table shows two important developments of the past 40 years. One is the rapid increase of electrification of American industry and the other is the proportion of purchased power. In 1899 the American worker had just over one-tenth of a horsepower to his hand; four decades later he had nearly six, an increase of more than fifty times. Therefrom stems the greatness of American industry.

Another thing in the tabulation of industry groups that requires explanation is the column of ratios of "Cost of Energy per Dollar of Product Value." The Census gives figures of costs of purchased energy, but not of costs of all electricity used. The figures for costs of that were arrived at by assuming that the cost of locally generated energy is the same as of purchased electricity. Then, having divided to obtain the unit costs of purchased energy, the figures of costs of total electricity used, on which the ratios were based, were easily arrived at.

The figures of this ratio of cost of electricity are evidence of a condition that is not appreciated. In fact, the general impression appears to be diametrically opposite. The public believes that electricity is one of the largest items in the costs of industry. As these figures show, it is actually one of the smallest. In only nine of the twenty industrial groups does the cost of electricity go above 1 cent in the dollar of product value and in eighteen of them it is under 2 cents. In a pair of shoes, for example, the electricity used in making them costs only 0.58 percent of the price at which the manufacturer sold them and is a much smaller proportion of the retailer's price. If the buyer pays $4 for the shoes, less than 2 cents of his money goes for the electricity used in making them.

The Census publications used for this analysis are entitled, "General Statistics for Industry Groups, for Industries and for Geographic Divisions and States" and "Power Equipment and Consumption." These pamphlets contain comparative figures on 447 industries in the same terms as those from which were derived the ratios on industry groups here presented. From these figures ratios for particular industries may be readily obtained by any one interested.

Electricity in Manufacturing

	Electric Energy (Millions of Kw.-Hr.)			Energy Used per Wage Earner (Kw.-Hrs.)	Cost of Energy per Dollar of Product Value	Ratio of Energy Used to Dollar of Product Value (Kw.-Hr.)
	Used	Purchased	Ratio of Purchased to Used			
ALL INDUSTRIES, TOTAL	70,868	45,040	0.64	8,986	1.28¢	1.25
FOOD and Kindred Products	6,388	4,998	0.78	7,755	0.90¢	0.60
TOBACCO Manufactures	115	66	0.57	1,314	0.14¢	0.09
TEXTILE—Mill Products and Other Fibre Manufactures	6,804	5,202	0.76	6,285	1.78¢	1.73
APPAREL and Other Finished Products Made from Fabrics and Similar Materials	353	342	0.97	470	0.37¢	0.11
LUMBER and Timber Basic Products	1,237	526	0.43	3,430	1.47¢	1.10
FURNITURE and Finished Lumber Products	605	418	0.69	2,061	1.03¢	0.48
PAPER and Allied Products	9,393	3,258	0.35	35,483	3.67¢	4.65
PRINTING, PUBLISHING and Allied Industries	860	813	0.95	2,650	0.75¢	0.33
CHEMICALS and Allied Products	9,811	5,554	0.57	34,168	1.68¢	2.63
Products of PETROLEUM AND COAL	3,440	1,909	0.55	32,629	0.87¢	1.16
RUBBER Products	1,585	1,082	0.68	13,127	1.66¢	1.76
LEATHER and Leather Products	402	297	0.71	1,227	0.58¢	0.29
STONE, CLAY AND GLASS Products	4,852	3,259	0.67	16,875	3.30¢	3.37
IRON AND STEEL and Their Products, Except Machinery	12,236	7,651	0.63	12,662	1.80¢	1.86
NON-FERROUS METALS and Their Products	5,956	4,794	0.80	26,037	1.20¢	2.31
ELECTRICAL MACHINERY	1,432	1,015	0.71	5,584	0.97¢	0.83
MACHINERY, Except Electrical	1,985	1,643	0.83	3,796	0.92¢	0.61
AUTOMOBILES and Auto Equipment	2,467	1,421	0.58	6,184	0.71¢	0.61
TRANSPORTATION EQUIPMENT, Except Automobiles	482	419	0.87	3,068	0.69¢	0.55
MISCELLANEOUS Industries	465	383	0.82	1,947	0.18¢	0.40

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Steaming vs. Generator Overload Capacity

A standard type Loomis closed feedwater heater installation was recently completed by the Northwestern Electric Company at Lincoln Station in Portland, Ore., bleeding steam from No. 3 20,000-kva. turbine. It requires about 66,000 lb. of steam per hour, raising the temperature of 600,000 lb. of feedwater about 125 deg. at full load.

Naturally this operation cuts down the overload capacity of the turbine, although it is still able to carry 21,000 kw. in the generator with heater in. With the heater out it can carry about 24,000 to 25,000 kw.

Over all, the installation is proving very satisfactory, increasing the steam production capacity of all the boilers approximately 10 percent. At all times it lies within the discretion of the operating department as to which is the most desirable, under any given conditions, to take advantage of the increased efficiency of the boiler plant or to utilize the overload capacity of the generator to the utmost. In other words, it can either save fuel or furnish overload capacity in a pinch, whichever best meets the requirements of the war effort at any given time.

PRIORITIES PROBLEMS
(Housing)

IN PLACE of the usual case study analyses of priorities the Priorities Problems pages in this issue are devoted to a Question-and-Answer symposium covering wartime regulations of residential extensions of utility services. The questions and answers have been prepared with the cooperation and assistance of WPB's Power Division in an effort to help utilities to understand what extensions can and cannot be made and the procedures set up for authorizing extensions.—EDITORS.

Unlimited extension of utility services to American homes and shops has been halted for the duration of the war because of the extreme need for copper and steel and other critical materials in war production. Broadly speaking, the only residential service extensions now permitted are those which clearly are needed in the war effort—for war housing and to maintain cooking facilities. Even these limited operations have been placed under strictly defined procedures. The questions and answers which follow touch the points most frequently asked about by utilities operating under these wartime rules and regulations and are divided, as nearly as possible, topically to cover range extensions, housing extensions, farm extensions and procedure:

Range Connections

1. Q. Does the individual consumer file an application to WPB for an extension to serve his range?

A. No, utilities have authorization under Order P-46b to make connections within specified limits.

2. Q. What are the P-46b limits?

A. The utility may make a connection where the dwelling has no other range, including hand-fired ranges such as coal or wood, installed at the time service is requested, and may extend electric service only where there are no gas facilities into the house, or vice-versa. The utility may not use more than 15 lb. of copper conductor in the case of an electric extension nor more than 170 lb. or 75 ft. of 1¾-in. pipe in the case of the gas extension.

3. Q. What procedure can be followed in cases where the extension exceeds the materials limits?

A. The utility may file an application with WPB's Power Division in P-46 withdrawal letter form if the materials are on hand, or on a PD-1A form if the materials must be purchased. Only in very unusual circumstances are such applications granted.

4. Q. If a house has both a third wire for electric cooking and a gas pipe, can the consumer select which type of cooking he wants?

A. Yes, but in such cases the type of service requiring the least amount of materials for interior connection should normally be selected.

5. Q. If there is gas service to a house and the consumer wants a third wire extension for electric cooking, can he get it under P-46b?

A. No, as P-46b is now written. However, in instances where a family owning an electric range moves into a house which has gas facilities installed, but is not equipped with a range, the utility may apply to the Power Division for permission to make the extension. Such applications originally were rejected, but are now usually granted and P-46b may soon be changed to give utilities blanket authority in such cases.

6. Q. What does the term "complete facilities" mean?

A. This means facilities from the point of connection with the utility's lines up to the kitchen. A house with a gas pipe to the basement only is not considered to have complete gas facilities installed, nor is a house with a three-wire service but no interior range wiring considered to have complete electric cooking facilities.

7. Q. If the house has a gas line or a third wire, but has no interior facilities for connecting a range, what can be done?

A. The consumer may install the interior facilities without permission under Order L-41 if he has the materials, or can get them without priorities assistance, and the cost is less than $200. If a preference rating is needed or the cost is over $200, application on forms PD-406 or PD-200 must be made.

8. Q. Where a home owner duplexes a house having both gas and electric facilities for the original kitchen, can the utility extend service for cooking in the second kitchen?

A. Yes, either gas or electric service. Wherever possible this should be done by extending the interior facilities rather than by a new tap from the distribution line.

9. Q. Is it necessary for the utility to file a PD-545 with a consumer's PD-200 or PD-406 application for remodeling a house, where the only utility service involved is a cooking extension which can be made under P-46b.

A. No, but the utility should file a letter with the remodeling application stating that it can make the connection under P-46b. (See Question 12.)

10. Q. May a service extension be installed for hot water heating in an old house?

A. P-46b does not permit extensions for hot water service alone. Service may be extended for hot water as part of a range extension if the combined job can be done within the materials limits.

11. Q. What about water heating in a new house?

A. This is permitted along with other utility services within the Housing Standards limits.

12. Q. If a service extension for a range can be made under P-46b, can lighting and other service be provided also?

A. Yes, so long as not more than 15 pounds of copper conductor is used.

Housing Extensions

13. Q. What does a utility do to get authority to extend service to a new house or to an old house newly wired under a preference rating order?

A. The utility files a Form PD-545. Where the preference rating for the dwelling construction or wiring has not been granted, the PD-545 must be filed at the same time as the application from the housing contractor.

14. Q. What is an "unrated" house?

A. It is one for which no priority assistance for construction or remodeling has been granted.

15. Q. What procedure does the utility follow to get authority to extend service to an unrated house not coming under the limits of P-46b?

A. The utility files a P-46 withdrawal letter if the materials are on hand or a PD-1A application if they aren't.

16. Q. What can be done when a utility extension is requested for a new rated house in instances where the Housing Standards are exceeded?

A. The utility should file a PD-545 in the usual manner, giving a detailed list of excess materials involved and an explanation as to why the Housing Standards must be exceeded. These applications will be sent to WPB's Power Division for review. Most of them are turned down.

17. Q. Must the portion of an extension installed by the builder be added to the utility extension to determine conformity with the Housing Standards?

A. Yes.

18. Q. Should the utility, before filling out the PD-545, determine the utility materials to be owned by the builder?

A. Yes.

19. Q. How should this be done?

A. The utility should obtain an itemized list of utility materials to be owned by the builders. This should be attached to the PD-545.

20. Q. What should the utility do if it has no No. 8 conductor required for service extensions under the Housing Standards and can get none?

A. Have some larger size conductor from its stocks redrawn. Permission is required from the Copper Division for this; it is obtained by writing the division a letter.

Farm Extensions

21. Q. Can a utility extend service to a farm for residential lighting and for other use on the farm?

A. Not unless the farm residence was wired prior to March 26, 1942, or is for service to a customer who previously had service and was forced to move because of the construction of an army camp or other war establishments, and not unless the extension can be made with 2,000 ft. or less of steel primary. Even when these conditions are met a separate application for each extension is required.

22. Q. What does the utility do to get authority to make a service extension to a farm where the residence was wired prior to March 26?

A. The utility files a P-46 withdrawal letter if it has the materials on hand, a PD-1A application for a rating if the materials must be purchased.

23. Q. Should the utility use a PD-545 form for an extension to serve a farmhouse and other farm equipment?

A. Not unless the house is a new building constructed on a PD-105 or a PD-200, or unless the wiring of an old house was given a preference rating or application is being made in a PD-200.

Procedure

24. Q. What is the PD-545 form?

A. This is the standard WPB form for utility service dwelling extension applications. It is used in all instances except for unrated houses.

25. Q. When does the utility file the PD-545 form?

A. Not until it is requested, by the FPHA, FHA, CWB or the owner who has had a written request for the form from FHA or CWB. It is not necessary for the utility to prepare a PD-545 form until the housing application has received an initial "screening" by the housing authorities.

26. Q. Where are PD-545 forms filed?

A. With the local FHA or CWB offices in all cases except publicly financed projects.

27. Q. What kind of extension cases are filed with the County War Boards?

A. Farmhouses.

28. Q. Where do PD-545s involving publicly financed projects go?

A. To the Federal Public Housing Authority office, from which request is received.

29. Q. Where are applications other than those made on PD-545 filed?

A. With the Power Division, War Production Board, Washington, D. C.

30. Q. What are the Housing Utilities Standards?

A. These standards specify the engineering, design and materials limits which utilities may use in constructing extensions to serve new residential customers. The standards now in effect are those issued under date of August 25, 1942.

Editorials

S. B. WILLIAMS, *Editor*

High Taxes and Reserves

NOW that utilities have had an opportunity fully to digest the new tax bill, is it as devastating as it first appeared to be? Judge Healy of SEC voiced his doubts earlier in the month before the utility commissioners' convention. He called attention to the certificates of necessity held by a number of companies, to the preferred dividend deductions and to the post-war 10 percent credit, and indicated that in certain instances the companies might pay a substantially lower tax bill.

The judge is right only if the companies try to take advantage of their certificates of necessity as an opportunity to escape taxes for a five-year period. Companies that have a longer vision will take the advice of utility commissioners and others and apply tax savings to amortization of investment.

When the war is over there will once more be strong pressure for lower rates. Some of this pressure will come from the commercial departments of the utilities, some from regulatory bodies and some from the threat of competition. Anything that can be done now to lower tomorrow's fixed charges will help to meet the rate challenge.

These high utility taxes, which for a while appeared almost confiscatory, might under wise management prove to be advantageous, especially to those companies with inadequate reserves. A year ago Commissioner Manly of FPC advised what might be done in periods of increased gross to bolster up reserves. If it is true that taxes will prevent any but self-defeating rate raises from making a dent in the net, will it not be found that deductions from gross will have the same relatively small effect on net?

The Case Against National Dimout

CONSIDERATION is being given in certain official circles to extending the dimout now in force in coastal areas to cover the entire country as a protective measure against hostile aircraft. The idea is so discrepant that one becomes suspicious that perhaps it had its inception not so much in protection as in saving electricity.

Although there hasn't been any indication of an impending serious power shortage, there has been evidence of an increase in public expression that electricity should be saved. What is behind it all?

You can't save electricity unless there is a shortage, because what you don't use isn't made. Electricity isn't like the metals that it can be stored. Of course, if there were a shortage in water or fuel, then what one person did not use would be available for another. But we have full reservoirs and go into the winter with the largest supply ever of coal in storage, 105 days.

Should shortages develop, every effort should be made to save electricity, but until then the only thing accomplished by the dimout is to reduce power company revenue, kill and injure twice as many people or more on the streets at night—a large percentage of whom will be war workers—reduce the patronage of the local merchants, and generally make people feel gloomier at night.

That isn't the way to win a war.

Blackout Load Recovery Problems

EXTENSION of blackout regulations to include practically all the war-work plants may possibly alter the attitude plant and system operators have acquired with regard to the tests. When the survey article on the subject appeared in the August 22, 1942, ELECTRICAL WORLD the experience caused us to give it the title "Plants Take Blackout Load Changes Comfortably." Now, however, there is an expectation that loads at the bottom of the blackout may dip to half or even less than half the load initially.

Operators should have as much foreknowledge as possible so they will not pop visible steam. Perhaps more significant is the tax that quick resumption of loading from a low base puts on the fuel combustion facilities to keep up with the steam that must be drawn from the boiler. Oil burners can pick up very fast, but every effort is being made to conserve fuel oil, so the bulk of the burden is thrown back on pulverized-fuel burners and stokers. Just how quickly they can establish steam output on resumption of loading is something that should be ascertained for each plant and unit. That goes along with the companion matter of sudden changes of stress and temperature gradients in boiler and turbine.

Above all, the operators should be rehearsed in the steps to take if the frequency should begin to sag ominously as load comes back. Refusal to pull up with the load is a rare phenomenon, but its unexpected occurrence should not nonplus those who have seldom seen it. Their long training to "hang on to the load" may have to give way to a new philosophy of holding part of the load while deferring other parts in order to be able to resume after a deep blackout.

If, as is believed by some, the minimum desirable load from which to recover near to full loading is 40 to 50 percent, then other units may have to be in readiness to share and dilute the resumption effects. Hydro, if avail-

able, can take over a large share of the pick-up duty. But in order to be available the lines must be kept closed. On that point two opposing schools of thought are found —one intent on keeping the system intact so that bombed-out capacity can be replaced from elsewhere, the other intent on reducing line transfers to a minimum and relaying primarily on local generation. In view of British experience on line outages there would seem to be justification for retaining and working all the interconnection links. At least that pattern of action would come nearer to assuring that systems can take blackouts, both going off as well as coming on.

Renegotiation of Power Contracts

SOME utilities have been notified that investigations will be made for the purpose of renegotiating contracts. On what basis will the rates in these contracts be judged? With certain large contracts that have incremental investment pretty well defined and isolated there is one condition, but with small industrial loads for which little or no incremental investment was especially made there is an entirely different problem.

With a manufacturer bidding for government orders it may sometimes be good business to guard against contingencies with a protective price. Later, when all the costs are in, it may be found that costs are lower than estimated for several good reasons. The workers, for instance, might have become more proficient, or new methods might have reduced errors and consequent spoilage. None of these conditions exist in utility service, so it is difficult to see wherein a renegotiated contract for the same service can save the government anything unless the utility is willing to make a sacrifice under pressure. This is on the assumption, of course, that the government wasn't asleep at the switch when the original contract was drawn up.

The time to negotiate a power contract is before the signing. If during the life of the contract conditions change materially, such as the price of fuel or the nature of the demand, then negotiation has a place. However, that presupposes that renegotiation works both ways. Does it, or is this one-way regulation?

A Source of Engineering Manpower

WHILE the Army and the Navy continue to call for more engineers, hundreds, perhaps thousands of engineers, we know not how many, are kept busy at original cost studies demanded by regulatory authorities. Is this essential to the winning of the war? Would regulation lose anything if these studies were postponed until the war was over? What is it that regulation fears will happen if the determination of historic cost is deferred until after the war?

It isn't as though this were an old-established continuing piece of regulation, for no one with a grain of sense would recommend any postponement of customary regulation. This is something new. And when it is finished it can be of no earthly use except to be the basis for reducing rates. Today's taxes leave little room for lower rates.

If the Army is looking for a whole flock of competent engineers, why doesn't it find out what is available in this direction—or has it?

OPA and the State Commissions

ALTHOUGH OPA has made public efforts to disabuse the minds of state utility commissioners that it has any intention of usurping their prerogatives in rate regulation, there is still the feeling that it will make no effort to interfere only so long as it gets its own way.

Commissioners are asked to view the matter as a part of the national picture and since state commissions are less likely to have competent information of their own in that respect they are urged to consult with OPA, which does have the interrelated national data. This is an extremely subtle way of putting the state commissioners at a disadvantage.

However, the impact of utility rate changes on the national economy is not large. The only place where this would show up would be in industrial rates. Census data show that power represents on the average but one and one-half percent of the cost to manufacture goods. If there were an upward change of 10 percent in power rates this would be but between one and two-tenths of one percent of the cost to manufacture.

But there is no intimation that utilities are contemplating any such extensive rate revisions. The practicalities of the moment with regards to war taxes are a great deterrent. There are instances where adjustment may be needed, such as in contract renewals and fuel clauses. In these cases the power companies will not be asking for any general rate increases but rather for rectification.

In the meantime OPA has issued rules which utilities seeking general rate increases must follow. They have one wondering if perhaps OPA really meant it when it said that rate regulation was a matter for local regulatory agencies to determine, especially when companies are asked to report original cost of facilities for which the increase is sought.

Of course, we shall have a clearer picture of the authority of OPA in the matter of utility rates after the courts rule on the Washington Gas Light case. The District commissioner has refused the request of OPA to reopen the case. This challenge is bound to bring an appeal for judicial direction.

And so it would appear that OPA has all the intention in the world to let state commissions determine rates so long as they behave and do not allow any increases.

Washington Comment

By RICHARD LARKIN, Washington Staff

Repair Parts Assured for Essential Appliances

TRANSFORMATION of the nation's war economy from the get-ready to the turn-it-out stage is elevating the repair parts program for essential civilian appliances to a parity with military production.

WPB is working toward a merger of military and civilian production into a single wartime program in which the minimum civilian output which is allowed will be guaranteed necessary critical materials. Consequently, WPB has decreed that repair and maintenance of essential durable goods—as well as industrial maintenance—will be eligible for the top AA-1 priority rating where needed. Under the Controlled Materials Plan which goes into effect next year, steel, copper and aluminum will be allocated not only by pounds but also for specific uses.

Limited to Essentials

This optimistic prospect must be viewed realistically, however. The idea behind it is not so much to keep dealers in business as it is to keep the civilian population in business—the war business. As such, the new program will be one of restriction and regulation. Those electrical appliances which WPB does not consider necessary to civilian living will get no more repair parts unless they can be fashioned from unrestricted materials and manpower. Those parts of essential appliances without which the devices can function will be prescribed just as if they fitted a non-essential item. Frills and non-functioning parts of essential appliances will have no place on the list of civilian products eligible for allocated materials.

One restriction which can be expected reasonably soon is an order requiring that no repair part be installed except in exchange for an unusable part. Some WPB branches and some manufacturers already are operating informally under this procedure. One of the principal reasons for this requirement is to prevent hoarding, although the reason generally credited for the turn-in procedure is that it provides valuable scrap. While dealers have been sending parts back to the manufacturer, plans are being discussed whereby parts put in local scrap will receive a credit which can be used against purchase of new parts.

In establishing the new policy of providing planned minimum requirements for civilians, the policy makers set up some problems which will be difficult to solve. The Office of Civilian Supply, being primarily responsible, is assembling a list of essential appliances and their essential parts. These lists should be ready next month, for, based on them, OCS will have to submit its requirements of steel, copper and aluminum to WPB's Requirements Committee on January 1.

Parts Manufacture

Where and by whom repair parts shall be manufactured is another major problem. Any decision must be based in part on the number of replacements to be made.

Repair parts may be sandwiched into the war production schedules of plants which made the appliances, or they can be concentrated in plants devoted solely to parts production. If the former alternative is followed, estimates of essential appliances will have to be broken down to include the number of different brands which are to be kept in use. Consequently, half a dozen manufacturers of a given appliance may have to interrupt war work periodically to turn out relatively small batches of parts.

If the concentration method is used, and it seems not to be highly regarded thus far, those plants selected will have to be furnished with plans and equipment.

Other factors must enter the decision. For one thing, if "A" manufacturer is to make all the parts for "A" appliances, and he may want to do so when he considers post-war trade, it must be determined whether he has sufficient facilities not engaged in war work to handle his quotas, or whether the civilian production must come out of the military hide.

If military production must be sidetracked for civilian parts, the question of how often to break the flow of military production must be decided. No manufacturer who has a plant full of war orders will be happy about interrupting them to make 50,000 parts which can be made most economically in batches of 200,000 or more. If he accumulates quotas into economical batches, civilian maintenance may suffer for a period of months.

Labor Problems

Eventually OCS and WMC will face what may be the toughest problem of all—that of supplying the labor force to service essential appliances. Many trained repair men have gone into military service and more are headed for it. Others are in direct war work. In the meantime, old appliances are becoming eligible for more and more service, and the thousands of new appliances manufactured and sold during the defense boom will be breaking into the repair market. If there are not enough workers to do the specialized work which appliance repair demands, the whole program will have been futile.

Distribution and pricing of essential repair parts provide other problems. The question of how to split up a limited supply of parts is being solved somewhat by the demise of service establishments. Whether this "subsistence" level of parts will ultimately force some sort of formalized dealer quota program is yet to be seen.

OPA is aware of the problem its price ceilings have imposed on dealers whose service used to be performed "loss leader" fashion for the good will it brought. Subsidies have been suggested as a means of obviating the necessity for any drastic punctures of constituted ceilings. But it's only talk.

Electronics—Secret Weapon of War

Presager of a New Scientific and Industrial Era

THE END of World War I left scientists with a new plaything. They did not know it at the time but they had their hands on a revolution. Within two years the world had radio broadcasting. Within ten years the whole art of motion pictures had been transformed as talking pictures replaced silent movies. Within twenty years television was born and people were seeing pictures in motion by radio.

The fulcrum of this revolution is the electron tube, a new tool of illimitable possibilities. One form of the electron tube is the familiar radio tube; the much publicized electric eye is another. There are many other forms, each having distinct capacities for saving time, saving energy, saving money, protecting life, limb and property.

The electron tube puts the electron to work—and the electron is the basic building-block of the universe.

Electronics is the new art, the new science of putting the electron to work. Radio and sound pictures and television are aspects of electronics; but there are many other facets of this revolution which have been brewing since the last war.

The electron tube has a typical American family tree. Edison made the basic discovery of the "Edison effect" some sixty years ago. This was followed by the invention of the "Fleming valve" and the "de Forest grid". Then Armstrong contributed his share, and hundreds of engineers in garret and cellar workshops and in the great university and industrial laboratories went to work on the tubes which employ electrons. The tube was a plaything before the last war but the world conflict brought it out of the toy stage and made it a practical, powerful tool.

Today the electron tube is guiding the destinies of the greatest armies and fleets ever engaged in the history of the world.

It is a part of the nerve center of the battleship, directing its course, finding its adversaries, broadcasting running accounts of air battles to its crews, directing gun fire and determining ocean depth.

In the air it is the means of locating and identifying enemy planes, piloting planes automatically, giving communication from plane to plane and to shore. It is even operating the controls of the plane.

In the maneuvering tank, in the officer's car, on the back of a foot soldier it transmits and receives vocal messages from every unit of the fighting forces.

Along our borders, and those of our Allies is an electronic screen which counts, follows and identifies enemy planes a hundred miles away through darkness and through fog.

In industrial plants there are electronic counters that enumerate passing articles faster than the eye can see; automatic sorters which discard defective, oversize, undersize, off-color articles; automatic cutters; devices which inspect the inside of things which the eye cannot see; controls which protect workers; controls of temperature; smoke eliminators; intruder alarms; automatic controls for whole batteries of machines.

In its October progress report on American industry, the War Production Board points out that the radio business is five times greater than a year ago. From 20 million dollars a month last fall, it has increased to well over 100 million dollars a month. Unfilled war orders are in excess of 4 billion dollars.

From such vast growth will emerge a new engineering of products which will immeasurably improve our peace-time living.

After the war broadcasting will be infinitely more satisfactory: radio receivers will perform with a new fidelity which will amaze us. Television reception will be as flawless as the motion picture. Present secret war developments will readily be convertible to peace-time devices that will improve our standard of living.

No longer will ships collide with other ships, with icebergs or the shore. No longer will trains collide and aircraft crash in flight.

Garage doors will open as we approach and automatically close themselves. Electric lights will automatically go on and off according to our wants and needs. Furnaces and boilers will be controlled and smokestacks will cease to belch wasteful smoke. Air will be made dust free and germ free. Food contamination will be checked, meat made tender.

Grade crossings will be made safe and auto traffic will be automatically controlled.

Medical science sees new wonders ahead. Already it is possible to see "whiskers" on germs, germs which heretofore had been but a blur when viewed through the strongest optical equipment available.

Today so much secret development is going on in the ultra-high-frequency field that little can be said of its great future. But, without divulging military secrets, it can be said that ply-wood is being dried electronically in minutes instead of hours. Ultra-high-frequency welding (not to be confused with flame welding controlled electronically) is being done dramatically and efficiently.

Ultra-high-frequency heating promises to revolutionize the baking industry—it may even heat our homes.

What is this miracle working tube that can see, hear, taste, feel and smell a thousand times more sensitively than was possible heretofore?

What is the electron? No one knows, not even the scientists who know how to employ it. Electrons cannot be seen or felt; but if 6¼ million million million electrons are pushed through a 100-watt electric lamp per second, it will light up to full brilliance. For electric current merely is a mass movement of electrons. Each electron carries its share of electricity, and since the electron has so little weight it can be moved easily and quickly. Therefore, electricity transported by electrons can be turned on or off with great ease and speed. The electron tube merely is a device that controls the flow of electricity. It is an amplifier of power which can be made to do wondrous things. The sound of a termite gnawing inside of a log can be amplified a million times . . . to a roar that can be heard over great distances.

Colors can be classified and matched to a degree not possible by any other means.

Chemical or vitamin consistency can be recognized by counting radio activity within the subject being analyzed.

There is no industry in which electronic circuits cannot be used to speed up production, to increase accuracy, to do heretofore impossible tasks of calibration and measuring.

The opportunities afforded the engineers who are developing this new "electronic age" are limitless.

* * * *

Today the electronic industry is 100% at war. It is meeting the exacting demands made upon it.

Never before was electronic equipment called upon to withstand temperatures ranging from 75 degrees below to 150 degrees above zero Fahrenheit. Never before did radios and transmitters have to withstand the shaking and abuse to which they are being subjected today.

War demands have called for much redesign, much change of materials and a new conception of operating to tolerances never dreamed of in peace-time material. As a result, electronic parts and equipment makers are building better devices.

Universities and colleges are working at top speed to produce electronic engineers, for every radio operator in a plane, every radio man in the ground forces and on ships, every man operating radar equipment or electronic control devices in ordnance . . . and there are many thousands of them . . . must be a trained technician.

The wall of military censorship is high but it is no secret that one of Britain's best weapons that keeps the Luftwaffe from exterminating London is a radio locator, a device that gives alarm of approaching planes long before they can be seen with telescopes. Scanning the horizon constantly the locator warns of the enemy's approach. In the nose of a night fighter, the locator informs pilot and gunner when the enemy is within range. Neither is it a military secret that gunfire can be controlled by electronics, and that electronics is having a big share in training our new armies.

Necessity draws a veil over the most dramatic uses of electronics in warfare, but among those who know there is nothing secret about the fact that many of today's wartime applications will revolutionize our peace-time lives. Electronics will invade every industry with totally new devices and machines. The future of the electronics industry is limited only by man's imagination.

Such is electronics, and its destiny!

President, McGraw-Hill Publishing Company, Inc.

This is the sixth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

NEWS OF THE WEEK

WPB Restores and Revokes Federal Power Projects

Keswick Dam and Shasta unit No. 5 put back on construction schedule — Priorities on five TVA units revoked in review by Eberstadt's facilities clearance board

WPB's new facilities clearance board, under Ferdinand Eberstadt, has completed its review of the government portion of the wartime power expansion program and has approved all but two projects originally included in the July 22 program drafted by the Power Division (ELECTRICAL WORLD, October 31, page 81 and November 14, page 82).

The two dropped projects were Keswick Dam and unit No. 5 at Shasta Dam, both of which the Power Division had considered eliminating from its original program. At the same time WPB revokes priority ratings on five TVA generating units originally scheduled for completion in 1944.

Federal projects which had not been included in the Power Division's July program, but which had been allowed to continue under A-6 ratings—too low to obtain any critical materials—have now been stopped, so that the manpower and construction equipment can be transferred to direct war work.

Utilities Review Undetermined

Whether the new board intends to make a similar review of the utility portion of the July expansion program is still undetermined. In line with its announced plan when the program was set up, however, the Power Division is undertaking a review to determine whether additions or subtractions should be made in light of the changing war program. Some 355,000 kw. of utility generator units on order were suspended, rather than halted, in July so that manufacturers' inventories could be kept intact pending a final decision this winter on 1944 requirements.

LAST COULEE CONCRETE—The last concrete pour to be made at Grand Coulee dam by Consolidated Builders, Inc., the contractors, flowed into place recently. The day's production brought to 10½ million cubic yards the volume of concrete poured on the project. Of the total, C.B.I. accounted for over 8 million cubic yards since the first bucket was lowered on April 4, 1938

WPB has revoked priority ratings which had been granted the Tennessee Valley Authority for the construction and installation of five power generating units, at three locations, having a total capacity of 190,700 kw. The units had been scheduled for completion in 1944.

Projects Ordered Stopped

The projects ordered stopped are:

Hydro-generating Nos. 3, 4 and 5, each with a capacity of 32,000 kw., at Kentucky Dam on the Tennessee River near Paducah, Ky. Units Nos. 1 and 2 at the same dam are not affected and are scheduled for completion in 1943.

Steam turbine generating unit No. 4, of 60,000 kw. capacity, at the Watts Bar steam plant in East Tennessee. Units Nos. 1 and 2 are already in operation and No. 3 is scheduled for completion in 1943.

Hydro-generating unit No. 3, of 66,700 kw. capacity, at the Fontana Dam on the Little Tennessee River in North Carolina. Units Nos. 1 and 2 are not affected.

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1941 Utility Plant at 15 Billion

FPC issues fifth annual statistical summary

Electric utility plant accounts in the United States aggregated nearly 15 billion dollars for the year ended December 31, 1941, it is reported in the Federal Power Commission's fifth annual bound volume of "Statistics of Electric Utilities in the United States," just issued.

The actual plant account value totaled $14,736,792,872, equaling 82.9 percent of total assets. Gross revenues for the year amounted to $2,621,479,875—98.5 percent of which was from sale of 159,359,572,000 kw.-hr. to 26,279,482 customers—indicating a book invest-

COPPER SALVAGE—Miles of underground cable, encased in solid lead sheath, once used to carry electricity at one of General Electric's plants, are now being unearthed in the company's salvage drive. Above, the crude but effective method of melting the lead off the copper cable into pigs is shown. Cable is fed to the fire and the molten lead allowed to run into the molds. Remaining cable is baled into furnace-size bundles and both the ingots and bundles shipped to mills for refining

ment of $4.86 in property for each dollar of annual revenue.

Data in the 500-page volume was obtained from reports filed with FPC by all electric utilities with annual revenues of $250,000 or more. Uniform tables of information for each reporting company is included. The book, designated as FPC S-25, is sold for $2 per copy by FPC.

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Niagara Falls Rate Cut Stay Denied

The New York Public Service Commission has denied a petition of the Niagara Falls Power Co. for a rehearing on the commission's order of November 6, which required the utility to reduce rates by about $1,000,000 on special defense power the company supplies to war industries.

The company has been licensed by the FPC, the commission said, to divert an additional 12,500 cubic feet of water per second from the Niagara River for the production of power. In addition it has to buy about 22,000 kw. of steam power from other sources to deliver a total of 112,000 kw. to various war industries. The company has agreed to supply this power at cost, but under the FPC license it had to set up a reserve of the difference between the cost of this power and 4 mills per kw.-hr. prescribed by the FPC. The Public Service Commission ordered the company to establish a rate equivalent to about 3 mills per kw.-hr., which would result in a reduction of $1,000,000 per annum from existing charges.

Commissioner Maurice C. Burritt pointed out, in connection with the case, the federal license provision with respect to the reserve to be set up on the basis of the difference between the actual cost to the company of producing the power and 4 mills, which the company charges for this energy, becomes inoperative when the Public Service Commission determines what the rate should be.

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SEC Surveys Court Opinions

Securities and Exchange Commission has compiled a 250-page digest of opinions of the United States Supreme Court and of state courts and regulatory commission on depreciation problems of utility regulation. The volume is divided into sections by states, giving statutory authority of the commissions, the system of accounts and a brief digest of all important court or commission decisions by specific case citation.

The study was compiled and edited by Herbert D. Miller, Daniel M. Reaugh and Nathaniel L. Nathanson of the SEC public utilities division staff. A limited number of copies of the report have been mimeographed and are available upon request from SEC at Philadelphia.

NEWS BRIEFS

MICHIGAN'S STATE CONSERVATION COMMISSION has appealed to the Attorney-General to start court action to determine the right to halt the Copper District Power Co.'s diversion of water from Bond and Agate Falls, two famed beauty spots on the middle branch of the Ontonagon River. The diversion, beginning in 1937, has drawn criticism from a number of resort and sportsmen groups. The proposed litigation will attempt to fix the commission's authority over water rights in the matter of diversion.

ALABAMA PUBLIC SERVICE COMMISSION has approved a proposal by the Alabama Power Co. to read electric meters every two months instead of monthly. The order provided that for the intervening month a bill be rendered for approximately one-half of the sum of the bill for the two previous months.

SEATTLE CITY COUNCIL utilities committee has directed preparation of an ordinance to accept the offer of the Federal Works Administration for a grant of $1,864,760 to apply on the project to increase the height of Ross Dam on the Skagit project. The project's total cost will be $10,164,760.

THROUGH THE OPERATION of lend-lease, the United States will turn over to Russia a new power plant with a capacity of 100,000 kw., it was anounced recently. Work in designing the plant, to be erected, it is understood, in the Ural region, already has started under the direction of Ebasco Services, Inc. The plant will be set up in four units of 25,000 kw. each and, on completion of the first unit, will be shipped overseas, to be followed by the remaining three. Total cost of the project is estimated at between $13,000,000 and $14,000,000.

A. W. ROBERTSON, chairman of the board of Westinghouse, and C. W. Kellogg, president of the Edison Electric Institute, will sponsor an "Industries Dinner" for Russian War Relief, it was announced recently by Lewis H. Brown, president of Johns-Manville Corp. and general chairman of the relief agency's industries division. The dinner will be held December 10 at New York's Waldorf-Astoria.

SLEEPERS OCCUPY ELECTRIC HOUSE—Hartford Electric Light has established night quarters for service men in its former appliance demonstration and load promotional premises at 294 Pearl Street in the Connecticut capital city. In the first fortnight of this use 658 men spent the night there, under the auspices of the local Y.M.C.A.

War Moratorium on "Death Sentence" Asked

"Needless hampering" of utility operations by governmental agencies is seriously retarding the war effort, special report of Investment Bankers Association holds

Declaring that the public utilities are indispensable as a war agency and that their treatment at this time is of the utmost social and economic importance, the public service securities committee of the Investment Bankers Association of America, in a special report made public this week, recommended that "needless hampering of utility operations by governmental agencies be suspended for the duration." Among hampering acts which the committee says are "seriously retarding the war effort," greatest emphasis was placed on the forced dissolution of holding companies during the war period under the "death sentence."

Progress Should Be Gradual

Holding companies are, with certain exceptions, "on the way out," the report stated. Their protection and support, their supplying of capital needs and credit were helpful during the period of expansion, experimentation and standardization of the industry, it added, but are no longer necessary, "at any rate for those companies whose subsidiaries are now self-sufficient." Progress in eliminating holding companies should nevertheless be gradual, it was felt, so as not to destroy values and unsettle markets.

Pressed now, compulsory disruption of holding companies has, according to the committee, seriously hampered the necessary all-out war effort of the industry by (1) taking the time of important men in litigation and contention, (2) causing undue and unnecessary expense to both the operating and holding companies, (3) instigating sales on unprepared and unreceptive markets, (4) disturbing the very foundation of the productive machinery of the industry.

As another consequence, forced dissolution of companies and systems in thin and unstable markets has "greatly stimulated new financing by 'revenue districts' and the municipal buying of properties through the issuance of revenue bonds," the report said. This was said to lead to the "municipalization" of the business. The exemption from federal taxation thus afforded, it added, makes the financing of municipal ownership and support of the resulting debt comparatively easy.

"We also hear," the report continued, "of the suggested formation by 'public power groups' of non-profit corporations which are to be free of taxation." The committee considered such moves of "highly disputable value both from an economic and social standpoint."

The report pointed to a "paradox" of having government agencies stressing the need of equity financing and at the same time insisting on the writing off or freezing of surplus accounts or the writing down of property values of operating companies after these values had been long accepted by local commissions, thus making the sale of equity securities difficult and speculative.

Multiple taxation is a further blight on the utilities and their stockholders, the report stated, citing many instances of gross receipts taxes by city, county and state piled on top of income and excess profits taxes, leaving little or nothing for corporate surplus or stockholders.

The Securities and Exchange Commission's public bidding rule on the initial sale of public utilities securities would better have been left untried during the war period also, the committee contended. Its over-all recommendation was that all regulations that do not relate to current fraud prevention should be postponed "in this time of great emergency" and that government bureaus should refrain from unnecessary rulings, cease disrupting the normal operations of the utilities, avoid disturbance of markets, subordinating everything to the war effort.

The report was prepared by a committee of which Albert T. Armitage of Coffin & Burr, Inc., Boston, is chairman.

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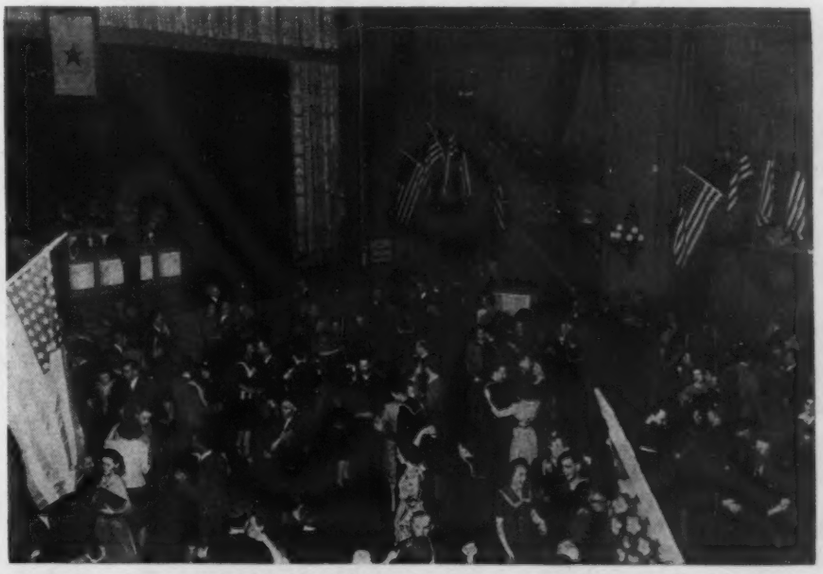
OPA Appeals Rate Case

Loser in its first court tilt involving a transit rate, OPA has appealed to the U. S. District Court of the District of Columbia to halt a $200,000 annual increase in the rates of Washington Gas Light Co. awarded by the District Public Utilities Commission under its sliding scale contract over OPA's objections.

OPA's court appeal in the gas case had been anticipated since the commission refused the agency's petition demanding the right to be heard on any phase of normal rate regulation it considered pertinent (ELECTRICAL WORLD, November 14, 1942, page 83). Issue which may be decided in this case is the extent of OPA's rights to intervene under the anti-inflation law.

The transit defeat for OPA came



GIFTS FOR UTILITY SERVICE MEN—Nearly half of Boston Edison's 3,000 employees attended a recent "Victory Parade" pageant and ball for the benefit of the 358 members of the company who have joined the colors. About $2,200 raised from the parade and "Penny-a-Day" boxes on the property has been assigned to the purchase of Thanksgiving and Christmas remembrances for these service men. About 300 service men joined the party as guests of the Edison Military Service Committee

when the district court refused to halt an increase in fares on a Seat Pleasant, Md., to Washington bus line which had filed notice with the Interstate Commerce Commission on September 26 before the new law became effective. The court held the company had "made" its increase on September 26, although it did not become effective until October 26 under ICC rules giving 30 days for entering of protests.

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Frankfort, Ky., Rate Reduction Ordered

Kentucky's Public Service Commission last week ordered a reduction of 22.3 percent in electric rates for the city of Frankfort, Ky., ending a long-existing controversy on the matter which stretched back to the days when the properties were owned by Kentucky-Tennessee Light & Power Co. In arriving at the new rate base, the commission included 1940 federal taxes as part of the company's operating expenses, thus refusing to pass wartime taxes on to consumers. The decision of the commission represented a victory for the city of Louisville, which had intervened in the case to fight for the reduction.

The controversy began on January 9, 1942, when the commission ordered the original company, K-T, to show cause why rates should not be reduced. Shortly thereafter, a local syndicate attempted unsuccessfully to buy the properties. On July 1, K-T, a subsidiary of Associated Electric Co., sold the bulk of its properties to TVA. The Frankfort system became the nucleus of the remaining properties of the K-T system which passed to a new holding company, Tri-City Utilities Co., formed to liquidate them. The city of Frankfort bid for the properties, but refused to meet the $1,350,000 price set upon them by Tri-City (ELECTRICAL WORLD, October 10, page 20). Finally, on October 12, Kentucky Utilities Co., a Middle West Corp. subsidiary, contracted to buy the properties for between $1,500,000 and $2,000,000, including eleven other smaller systems in the territory (ELECTRICAL WORLD, October 24, page 8). The city of Frankfort avows its intention of taking action on an ordinance authorizing the people to vote on the institution of condemnation proceedings against the utility next year.

The commission's decision found that the Frankfort electric system in 1941 earned $78,719 in excess of a reasonable return of 6 percent, on a rate base of $535,000. The reasonable return, the commission said, should have been $32,100, as compared with an actual return of $110,819.

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Coop Buys Light Plant

Purchase of the Salem (Ark.) Light & Ice Co. by the North Arkansas Electric Cooperative, Inc., for $17,500, has been approved by the Arkansas State Utilities Commission. The property was owned by J. E. Wolf.

SEC Issues Study of Utility Taxes

Securities and Exchange Commission analysts have prepared a study of the effects of the 1942 federal tax rates applied to 1941 returns of 27 utilities paying preferred stock dividends and having authorization to amortize over five years for tax purposes plant expansion installed to meet war loads.

The study shows that 22 of the companies would save a total of $8,908,911, while the five others would pay an increase of $1,651,959. Of the increases, $1,202,232 is charged to one company—the other increases are all relatively small.

The study, prepared under the direction of Commissioner Robert Healy, does not purport to represent actual 1942 taxes of the companies examined. Rather, it shows the effects of adjusting 1941 tax accruals to the 1942 tax law provisions which permit deduction of perferred stock dividends in computing corporate income surtax and provide for post-war refund or a credit against debt retirement of 10 percent of excess profits taxes.

For each company SEC has listed the amount of five-year amortization certificates held, 1941 preferred dividends, 1941 taxes, 1941 tax accruals adjusted to 1942 rates, tax saving from accelerated amortization, tax saving from preferred dividend credit, resultant 1942 taxes and the savings from the quick amortization and from the preferred stock credit. Names of the companies studied were withheld by SEC.

LAPP GETS ITS "E"—Presentation of the coveted Army-Navy "E" award, for excellence in war production, was celebrated at the Lapp Insulator Co., LeRoy, N. Y., recently. In the picture, left to right, are John S. Lapp, president; Major H. D. Newton, U. S. Army Signal Corps, Philadelphia, who made the presentation, and Grover W. Lapp, treasurer of the organization

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Radio Repair Parts Permitted

Radio manufacturers may supply replacement parts for home receiving sets outside the restrictions of Order L-183 which prohibits manufacture or assembly of electronic devices except on orders rated A-3 or higher, under Interpretation No. 1 of that order. Persons buying home radio replacement parts do not need ratings and distributors may replace their stocks through use of the standard PD-1X distributors' form.

Manufacturers who also have a distributing and servicing branch, under the interpretation, will have to operate the latter as though it is a separate concern, although no legal corporate split is required. In other words, the servicing division will obtain its home radio replacement parts from the manufacturing department just as any outside distributor—through use of the PD-1X.

DIMOUT STUDENTS—Five of the conferees who took part in a recent two-day meeting in Boston, under the auspices of the street lighting committee of the I.E.S., to discuss specifications for dimout control in coastal areas with U. S. Army. L. to r., J. W. Farley, executive director, and Major-Gen. Daniel Needham, head of protection division, Massachusetts Committee on Public Safety; Joseph M. Loughlin, U. S. Regional director, First Civilian Defense Area; Col. Harold E. Storke, U. S. A., Director of Internal Security, First Service Command, Boston; R. B. Brown, Jr., president I.E.S. and Illuminating Engineer Boston Edison Co.

Army Extends New England Dimout Area

Revised rules, effective November 30, include interior cities to reduce danger from air attack — Minimum window lighting now permitted

Revised regulations for dimming out the eastern and southern New England coastal area as a military safeguard have been issued by Major-Gen. Sherman Miles, commanding the First Service Command, Boston, to become effective one-half hour after sunset November 30. The region covered in the new rules has been extended into the interior to points approximately 20 to 25 miles from the sea and also has been enlarged to cover various so-called "island" centers of illumination such as Worcester, Woonsocket, Hartford, Bristol, New Britain, Meriden and Waterbury, lying in certain cases 40 to 50 miles from the coast. All the New England states except Vermont are named in these regulations.

To Prevent Attacks

The purpose of the lighting control is stated to be to reduce permanently certain lighting for the protection of United Nations and our own commerce from damage or destruction by enemy attack, for the prevention of enemy action against our shores, and for the control of illumination in critical areas so as to reduce the dangers from hostile air operations. This last is a primary reason for including in the rules the interior cities named, and which are manufacturing war material on a large scale. It is also the intention on the part of the Army to prevent skyglow being set up under winter conditions from remote interior points which might aid in the silhouetting of ships at sea. The restrictions apply until one-half hour before sunrise.

In general, all lights except automotive driving lights must be permanently shielded, obscured or reduced in intensity so that no gleam or reflection from these shall be visible from any point on the seacoast east and north of Old Saybrook, Conn., inclusive. All outdoor advertising and display signs must be extinguished. All exterior lights used for street illumination or traffic guidance, except automotive driving lights, are to be reduced in wattage and number "to the minimum consistent with their purpose," those retained in use to be permanently shielded to hide the light above a horizontal plane through that source. Under certain conditions named in the "Manual of Uniform Traffic Control Devices for Streets and Highways," Article A-11, page 56, published by the American Association of State Highway Officials, November, 1935, traffic signals shall be regarded as non-essential and are to be permanently extinguished.

Exterior lights used for outdoor manufacturing, in railroad yards, for repair work, shipbuilding, necessary handling or storage of raw or finished materials or for construction work are to be reduced in intensity and number "to a minimum consistent with their purpose." Those retained are to be shielded against the escape of light outside a 90-deg. cone. Protective lights are to be shielded so as to have the source invisible above a horizontal plane through the source. In parking lots, filling stations, playgrounds and amusement places outdoors no single light exceeding 40 watts (incandescent) is to be used, and 20 ft. spacing is to be the minimum, all such lights to be shielded to bring the cone of light directly downward and not exceeding 90 deg.

Show Window Lighting

Show window lighting cannot exceed the use of one 15-watt incandescent lamp or the equivalent per 8 ft. of horizontal linear opening. The upper half of automotive headlights is to be completely obscured. In thickly settled areas the lowest beam headlight must be used. Trains, street cars and buses visible from the seacoast must have all interior lights shielded from visibility on a horizontal source level plane without, and locomotive and street car headlights are to be dimmed. All windows and doors with lights behind must be screened for not less than the upper three-quarters of their open area, and in no case shall a source of light be visible out of doors above a horizontal plane through that source. In general, porch lights and other outdoor lights not before covered must not exceed 15 watts (incandescent) and must be permanently shielded in a 90-deg. maximum cone. Lights or reflections visible from outdoors (except official maritime or aerial navigation and obstruction lights and railroad signal lights) which cannot be extinguished, completely obscured or reduced in intensity in accord with War Department specifications within five minutes of a blackout alarm, must be permanently extinguished. Severe penalties are provided for infraction of these regulations.

Northwest Service Problems Discussed

Problems of electric service arising from wartime restriction on both customers and service companies were under discussion at a recent conference of the utilization section of the Northwest Electric Light and Power Association in Portland.

One of the most difficult problems now facing the area, that of restrictions on extension of service to new customers, was a high spot of the sessions. The nation-wide regulations governing such extensions are of particular concern in the Northwest because of the heavy growth in war-worker population.

Also thoroughly discussed was the problem of aiding industrial and commercial customers in maintenance of business and production under dimout and blackout requirements.

Another subject which received considerable attention was how various departments of electric service companies are aiding all classes of customers under war conditions, and the effect of tire and gasoline rationing on departments charged with maintaining efficient service.

J. C. Plankinton, commercial manager of Northwestern Electric Co., is chairman of the section. Representatives of nine electric service companies attended.

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Fix Fluorescent Fixture Standard

The Division of Simplified Practices, Bureau of Standards, has announced promulgation of a simplified practice emergency recommendation incorporating the designs for nonmetallic industrial fluorescent lighting fixtures developed by the industry in compliance with a WPB order denying steel and other critical metals for future manufacture of such fixtures. Mimeographed copies of the Simplified Practice Emergency Recommendation, designated ERI-42, are obtainable from the Bureau of Standards, Washington.

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320,000 Ice Boxes Scheduled for '43

WPB made no provision for manufacture of mechanical refrigerators in its program for production of 320,000 ice boxes during 1943.

The program involves a new principle, under which quotas assigned manufacturers will be based on the amounts of critical materials specified in ice box designs submitted to WPB. Largest quotas will go to those producers who will require fewest critical materials.

Officials of WPB's Consumer Durable Goods Division pointed out that substitution of ice boxes for mechanical refrigerators would save appreciable quantities of steel, copper, aluminum and rubber. Since most of the ice boxes probably will be installed in federal housing projects, the transportation problem for supplying ice boxes will be minimized.

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Kells Goes to Distribution Division

Charles W. Kells, former administrator of the utilities repair and maintenance order P-46 and now assistant head of the WPB Power Division's production section, has been loaned to the WPB Distribution Division to help formulate repair and maintenance procedures under the Controlled Materials Plan.

Coincidentally, J. A. Krug, director of the Distribution Bureau, announced creation of a Controlled Materials Plan Division within his agency to be headed by Harold Boeschenstein, president and general manager of the Owens-Corning Fiberglass Corp., as director, and W. C. Skuce, supervisor of materials procurement, priorities and inventory control for the General Electric Co., as assistant director.

MEETINGS

Previously Listed

American Society of Mechanical Engineers — Annual meeting, Astor Hotel, New York, N. Y., November 30-December 4. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

National Exposition of Power and Mechanical Engineering — Madison Square Garden, New York, N. Y., November 30-December 4.

National Association of Manufacturers—Congress of American Industry, Waldorf-Astoria Hotel, New York, N. Y., November 30-December 4. G. G. Geddis, 14 West 49th St., New York, N. Y.

American Society of Agricultural Engineers—Fall meeting, LaSalle Hotel, Chicago, Ill.; December 7-9. Raymond Olney, secretary, St. Joseph, Mich.

American Standards Association—Annual meeting, Hotel Astor, New York, N. Y., December 11. P. G. Agnew, secretary, 29 West 39th St., New York, N. Y.

Technical Valuation Society—Annual forum, New York, N. Y., December 12. W. C. Fisher, chairman, 33 West 39th St., New York, N. Y.

Missouri Valley Electric Association — Industrial engineering conference, Continental Hotel, Kansas City, Mo., January 13-14. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

American Society of Civil Engineers — Annual meeting, headquarters, New York, N. Y., January 20-22. George T. Seabury, secretary, 33 West 39th St., New York, N. Y.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 25-29. H. H. Henline, secretary, 33 West 39th St., New York, N. Y.

Regional "TVA's" For Nation Urged

Regional development of the natural resources of the country, along the lines of the Tennessee Valley Authority, was urged last week in a report of the National Planning Association. The authors were A. H. Hansen, special economic advisor to the Federal Reserve Board, and Harvey S. Perloff.

River systems and their watersheds, the report says, have proved to be the most appropriate and manageable areas for regional development as patterned on the Columbia, Colorado and Mississippi rivers and in the Tennessee Valley. It mentions the Central Valley, the Missouri Basin, the region of the Great Lakes and the Ohio Valley, the upper Mississippi and the Arkansas, White and Red rivers.

Such a comprehensive program of regional development is estimated to require a public investment of $2,000,000,000 a year for the next generation, but is expected to open opportunities for more billions of private investment.

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Interstate Electric Cited by WPB

Interstate Electric Co., New Orleans, La., a wholesale distributor of automotive parts and electrical supplies, has been denied all priorities and allocations of material during the period October 17 to January 17, 1943, by the War Production Board. The action was taken as penalty on WPB's charges that from June 5, 1942, to July 10, 1942, the company delivered 3,805 feet of copper wire and tubing to unrated orders or orders rated less than A-1-k in violation of Order M-9-a. Subsequent to May 7, 1942, WPB charges the company also made deliveries of copper tubing to unrated orders in violation of regulations.

The suspension order applied to Interstate was amended November 10, 1942, to authorize the concern to extend and apply ratings of A-1-a to deliveries of orders on its books as of October 17 so that war work deliveries would not be held up.

•

Bonneville 230,000-Volt Line Completed

Bonneville Power Administration officials last week announced the completion of a major 135-mile, 230,000-volt transmission line. The new line will permit delivery of up to 150,000 additional kilowatts from Grand Coulee Dam to war plants.

Week's Output Continues Gain

Rise in the output curve registered for the week of Nov. 14 was continued for the week ending Nov. 21 in a greater than seasonal ratio. Figures from the Edison Electric Institute showed that the amount of electrical energy distributed by the light and power industry for the week ended Nov. 21 amounted to 3,795,361,000 kw.-hr., as compared with 3,761,961,000 kw.-hr. for the week previous. Figures for the latest week bring the increase over the corresponding week last year to 16.9 percent.

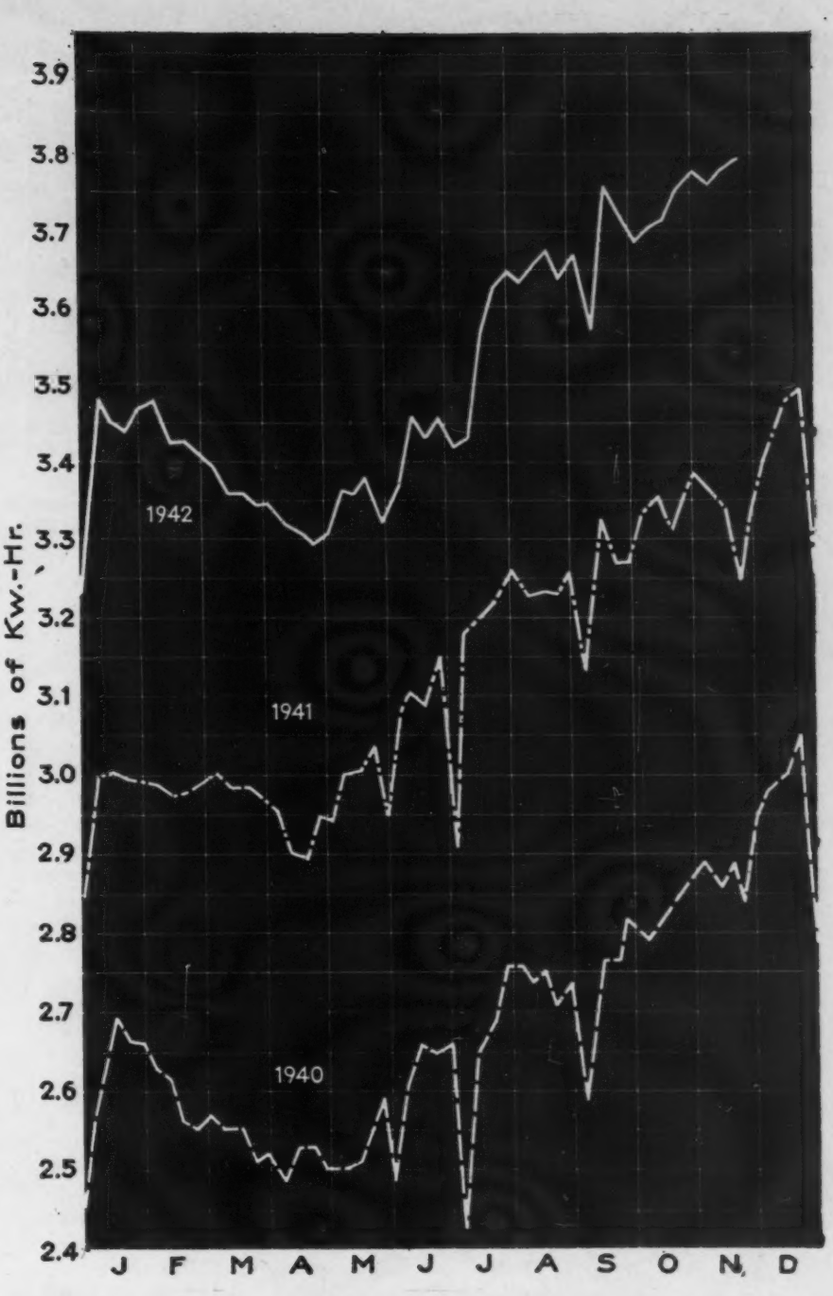
All of the major geographic sections of the country participated in the increase over the figures for the preceding year with a 3 percent rise for each region about average. The Pacific Coast area still leads the country in output over last year, with the Southern states a close second.

Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
Nov. 21	3,795	Nov. 22	3,248	Nov. 23	2,839
Nov. 14	3,776	Nov. 15	3,348	Nov. 16	2,890
Nov. 7	3,762	Nov. 8	3,369	Nov. 9	2,858
Oct. 31	3,775	Nov. 1	3,380	Nov. 2	2,882
Oct. 24	3,752	Oct. 25	3,341	Oct. 26	2,867
Oct. 17	3,717	Oct. 18	3,313	Oct. 19	2,838
Oct. 10	3,702	Oct. 11	3,355	Oct. 12	2,817
Oct. 3	3,683	Oct. 4	3,330	Oct. 5	2,792
Sept. 26	3,720	Sept. 27	3,273	Sept. 28	2,816
Sept. 19	3,757	Sept. 20	3,273	Sept. 21	2,769

Percent Change from Previous Year

	Week Ending		
	Nov. 21	Nov. 14	Nov. 7
New England	+10.6	+ 6.0	+ 2.4
Mid-Atlantic	+ 9.8	+ 6.4	+ 4.7
Central Industrial	+14.2	+ 7.7	+ 6.9
West Central	+12.9	+11.5	+10.4
Southern States	+25.8	+22.6	+20.0
Rocky Mountain	+11.8	+11.4	+ 9.7
Pacific Coast	+27.8	+26.0	+28.8
Total United States	+16.9	+12.8	+11.7



Floods Noted in Stream-Flow Report

The October record-breaking floods in the Potomac and Rappahannock river basins approach and at some places exceeded the previous flood discharges of record, notably that of March, 1936, according to the monthly report of the Geological Survey of the U. S. Department of the Interior in collaboration with the Dominion Water and Water Power Bureau of Canada, released last week. On the Shenandoah River, the report said, floodwaters rose six to eight feet above the high water level of the 1936 flood. The area of excessive stream flow covered 65,000 square miles, extending from eastern Kentucky, across West Virginia and northern Virginia to eastern Maryland.

Other pertinent information contained in the report included the following:

In a narrow belt from northern Mississippi to northern Indiana October stream flow averaged but 50 percent of normal.

In the West moderately below normal stream flow was generally prevalent, with limited areas of unusually low and above-normal discharge; no areas of excessive flow were reported. Flow in Washington continued subnormal.

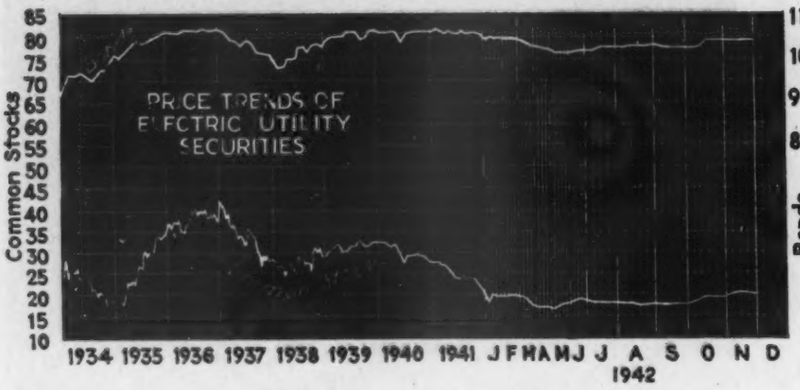
Ground water conditions over the country continued generally favorable except locally in areas of excessive pumping.

Uruguay Planning Power Projects

The government of Uruguay is planning an extensive postwar electrification program in order to prevent future fuel shortages such as exist at present, according to the Office of Coordinator of Inter-American Affairs. Due to the shipping shortage, Uruguay finds herself without adequate fuel for power—all of which must be imported.

The program calls for harnessing the Queguay river in the northwest, the Cunapiry River in the north and the Cebollati River in the northeast. These three projects, together with the large Rio Negro electrification project now under construction, ultimately will provide the republic with electric power.

Utility Stocks and Bonds Lose Ground



Electric light and power stocks, in line with the general market trend, lost ground the past week. "Electrical World" index dropped to 20.0 from 20.3 the previous week; last year, 20.7. Bonds dipped to 103.6 from 103.7; last year, 105.7

Puget to Vote on Refinancing

Directors of Puget Sound Power & Light Co. recently called a meeting of stockholders for December 15 to vote on the question of new issues of bonds and debentures totaling $60,000,000 to refinance the company's present first and refunding bonds at a savings of $1,200,000 annually in interest and amortization.

Marking the largest program ever to be "trusteed" in the state of Washington, directors named Seattle-First National Bank as trustees for the proposed $52,000,000 of first mortgage 3½ percent bonds and Peoples National Bank of Washington as trustee for the proposed $8,000,000 of 3 percent debentures. The two Washington banks would displace the Old Colony Trust Co. of Boston, trustees for the bonds now outstanding. Proceeds of the proposed issues would retire the present first and refunding bonds, outstanding in three series, with interest rates of 5½, 5 and 4½ percent.

Refinancing of the company's senior securities is contemplated as a step toward complete recapitalization of Puget Sound (ELECTRICAL WORLD, October 24, page 20).

•

Ask Refrigeration Equipment Sale

Owners of large-scale refrigerators and air-conditioning equipment who sell their machinery to war industries may be paid total cost, including installation expenses, less 5 percent depreciation for each year of use, OPA has ruled in an amendment to "Maximum Price Regulation 136," covering machines and parts and machinery services.

The price regulation was issued in connection with the government's program for shifting air conditioning and commercial refrigeration equipment from offices, stores, etc., to war plants requiring controlled temperatures. Sellers are required to report each transaction to OPA and if no disapproval is signified after 30 days the price is automatically Ok'd.

•

SEC Approves Sale of Carolina Utility

The SEC last week approved a voluntary plan of reorganization of Northwest Carolina Utilities Co., a subsidiary of East Coast Public Service Co., looking toward the dissolution of the company under the "death sentence" provisions of the Holding Company Act. The plan, in essence, provides for the sale of the assets of the company to the French Broad Electric Membership Corp. for $364,000 cash in aggregate. French Broad will acquire Northwest properties serving 24 communities in Madison, Mitchell and Yancey counties, North Carolina.

East Coast, parent company of Northwest, is the owner of all the funded debt of Northwest, consisting of $621,945 principal amount of first mortgage bonds, plus accrued interest amounting to $72,900. The plan provides that net proceeds from the sale shall be paid over to the trustee for the bondholders and distributed to claimants, with the subsequent liquidation of Northwest.

Consummation of the sale will leave all the properties of East Coast within Virginia.

FINANCIAL BRIEFS

THE SEC HAS DIRECTED that hearings be resumed on December 1 on the application of Virginia Electric & Power Co. to sell $4,000,000 of serial notes for plant expansion (ELECTRICAL WORLD, November 7, page 20). The commission approved the sale as of October 31 in order that the company might issue the notes on November 2. Jurisdiction was reserved, however, with respect to the treatment by the company of accelerated amortization allowed for federal income tax purposes.

MIDDLE WEST CORP. has filed with the SEC a declaration covering its proposal to sell to Atlantic Co., Atlanta, for $708,200 in cash all the securities and interests held by Middle West in City Ice Co. of Kansas City, Southern United Ice Co. and Western Ice Service Co.

THE SEC HAS ENTERED AN ORDER authorizing the Tri-City Utilities Co., a subsidiary of Associated Electric Co., formed for the purpose of disposing of the interests of the trustees of Associated Gas & Electric Corp., in Kentucky and Tennessee, to purchase 582,000 shares of its common stock from Associated Electric Co. for $582,000 in cash. The cash was derived from sale of Tri-City water systems located in Mayfield and Murray, Ky.

QUEBEC PUBLIC SERVICE BOARD has approved an application of the Lower St. Lawrence Power Co. to issue $200,000 of its 5 percent first mortgage bonds, due 1955. The company's bonds are authorized to an extent of $3,000,000 and the amount issued to date, exclusive of the new issue, is $1,480,000, of which $1,384,700 was outstanding on December 31, 1941.

Utility Reports

	Net Income 1942	1941
*American Gas & Electric and subs.	$10,726,263	$14,864,278
*Cincinnati Gas & Elec..	3,367,223	3,087,780
*Cleveland Elec. Illum....	6,439,757	7,355,351
*Columbia Gas & Elec. and subs.	7,568,988	11,043,778
†Detroit Edison and subs.	8,769,322	12,344,012
*Houston Ltg. & Power...	2,521,698	3,056,629
*Louisville Gas & Elec. and subs.	2,995,157	2,765,536
*Mississippi River Power..	1,588,221	1,449,922
*Niagara Hudson Power and subs.	6,376,240	8,778,799
*Pacific Gas & Elec.....	21,597,015	21,677,626
†Public Service N. J. and subs.	18,074,832	21,079,881
*Stone & Webster and subs.	2,154,907	1,744,767
*Union Electric (Mo.) and subs.	8,430,098	7,628,746
*Washington Water Power and sub.	2,134,968	1,895,053
*West Penn Elec. and subs.	3,996,702	4,901,135

*Twelve months ended September 30.
†Twelve months ended October 31.

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

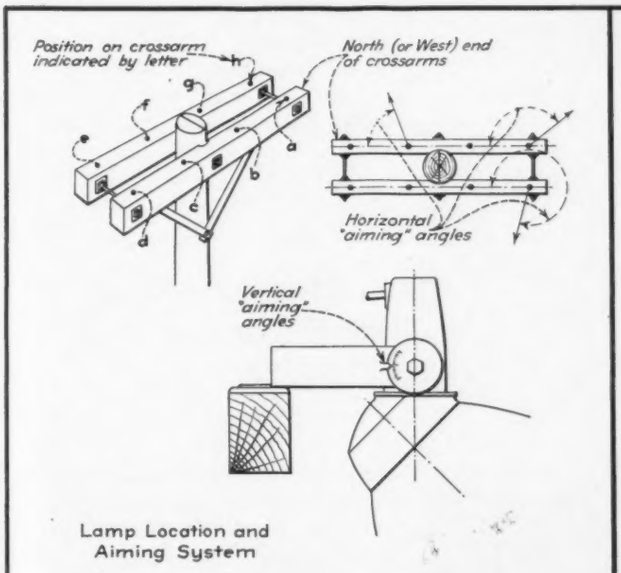
Initial Design Simplifies Floodlighting

Careful initial design coupled with standardization of equipment assured conservation of critical materials, economy and speedy installation for a floodlighting job designed to permit round-the-clock operation of a West Coast naval shipyard.

Pole spacing and mounting heights were predetermined to suit the characteristics of the equipment used and the intensities required. To insure simplicity in design and economy in maintenance a single 1,500-watt floodlighting unit was selected as standard. It uses standard 9½-in. light-center length general-service lamps. Variation in reflector finish gave two beam widths—33 deg. with a polished reflector and 80 deg. with an etched finish.

All lights were mounted on short (4-ft.) double crossarms attached to wooden poles. Poles with 14-in. or larger diameter butts were used with top crossarms set 50 ft. above the ground. Poles were set 10 ft. deep in earth or were bolted to deck structures of docks or shipways by means of welded steel bases. Crossarms held one to six lights, depending upon pointing angles. Where conditions required, a second pair of crossarms were mounted 3 ft. below the top set. Arms were always pointed north and south or east and west to be broadside in the direction requiring the most light.

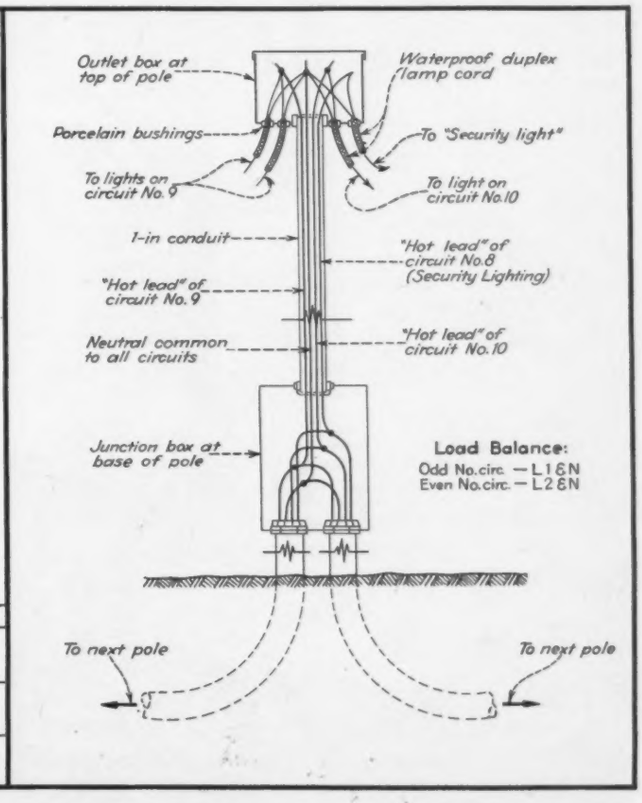
Location and aiming of all lights were scheduled on the drawings in accordance with predetermined requirements. Horizontal angles were recorded as azimuth angles and were


Position on crossarm indicated by letter
North (or West) end of crossarms
Horizontal "aiming" angles
Vertical "aiming" angles

Lamp Location and Aiming System

POLE AND MOUNTING SCHEDULE

Poles			Crossarms			Lamps				Circuits			Remarks
No.	Type	Length	Top	Bot.	Dir.	Place	Type	Hor. ∠	Vert. ∠	No.	Pole Feeder	Pole Riser	
17	B	60'	2	—	E&W	b	WA	65°	0°	23	*2/0	*8	
						d	WA	115°	Dn. 5°	24	*2/0	*8	
						f	LR	275°	Up 15°	19	*1	*8	Security
18	A Stl. Base	50'	2	2	N&S	a	WA	0°	Dn. 5°	23	*1	*8	
						c	WA	90°	0°	23			


Outlet box at top of pole
Waterproof duplex lamp cord
Porcelain bushings
To "Security light"
To lights on circuit No. 9
To light on circuit No. 10
1-in conduit
"Hot lead" of circuit No. 8 (Security Lighting)
"Hot lead" of circuit No. 9
Neutral common to all circuits
"Hot lead" of circuit No. 10
Junction box at base of pole
Load Balance:
Odd No. circ. — L1 & N
Even No. circ. — L2 & N
To next pole
To next pole

DESIGN DRAWING showing how location and aiming of floodlights were predetermined and scheduled

POLE WIRING was designed to simplify installation and control and to afford proper load balancing

measured clockwise from the north or west end of the crossarms. Vertical angles were given in degrees "up" or "down" using the quadrant and index engraved on the supporting bracket and trunnion of the lighting unit. This system eliminated all final adjustment pole climbing except where mistakes had been made in the setting.

Underground distribution was used outdoors with poles located near manholes and served from these by buried conduit risers. Each separate lighting unit was connected to the circuit designated in the design drawing by flexible cord from a common outlet box at the top of the pole. Poles adjacent to buildings were connected through service heads to conduits run along eave struts.

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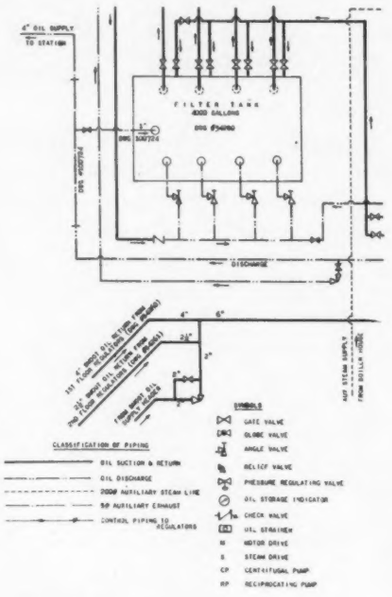
Billing Machine Used to Letter Drawings

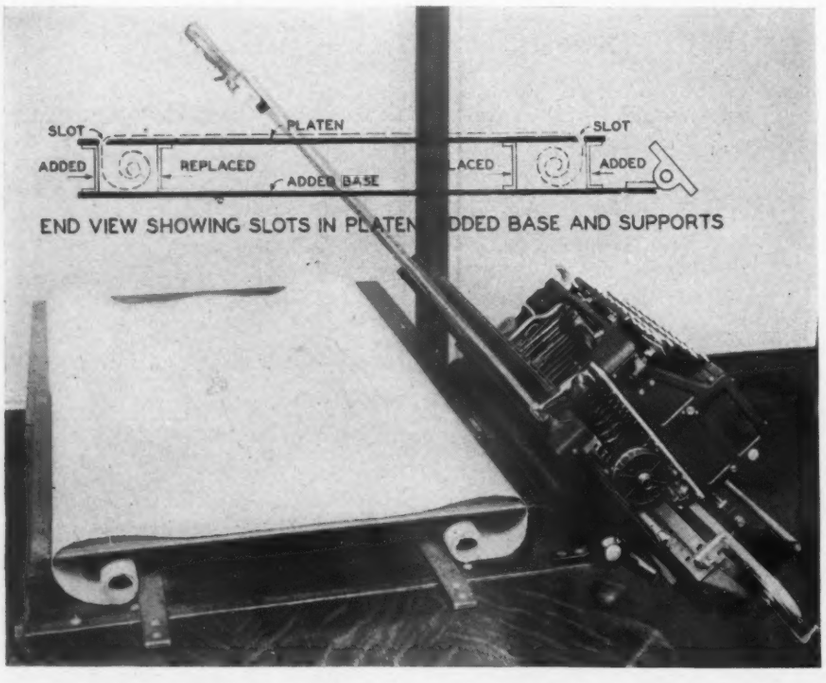
By F. P. KUHL
Chief Draftsman, Consolidated Edison Company of New York, Inc.

Complete or partial lettering jobs on engineering drawings may be done on a typewriter by a stenographer or typist, from dictation or a draftsman's longhand notes. The typing machine which will accommodate large drawings is not only usually high in cost but the visible working area is limited. In large engineering organizations acquisition of this type of equipment is easily justified by the volume of lettering performed, but in smaller organizations of eight or ten draftsmen the cost would probably prohibit its use.

An economical means of obtaining a machine with the desired characteristics can be had by modifying an Underwood Elliott Fisher billing machine, as shown in the illustration. The platen was cut into three sections, which were resupported from a sub-base by means of spacer feet. Cutting the platen into three sections formed two slots which allow the drawing to pass and to be rolled in the space between the platen and the sub-base. This arrangement will take any size drawing, both as to length and width, and provides a composing area of 18 in. vertically by 16 in. horizontally for one setting. The tracing may be slid lengthwise or rolled vertically for other settings.



MACHINE LETTERING on a drawing



END VIEW SHOWING SLOTS IN PLATEN ... ODED BASE AND SUPPORTS

MODIFIED billing machine

Style of Type

Pica Gothic type is recommended because of its clear, sharp images and freedom from curlicues and tails. Other smaller or more elaborate types tend to clog.

Care should be taken in the choice of a ribbon. The ribbon should not require carbon backing to obtain an opaque image. It should be quick-drying to prevent smudging, be free from bleeding on the surface of the drawing, and leave no ghost marks after erasures are made.

It will be found that complete typing jobs on drawings are uneconomical from a time-saving viewpoint, and that it is more efficient to confine the machine work to titles, voluminous notes, bills of material, etc., leaving minor notes and dimensions to be lettered by the draftsman. Poor freehand lettering may be corrected by the use of a mechanical guide. This combination will result in drawings which have a much better chance of being considered acceptable.

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Refrigerants Used for Expansion Fits

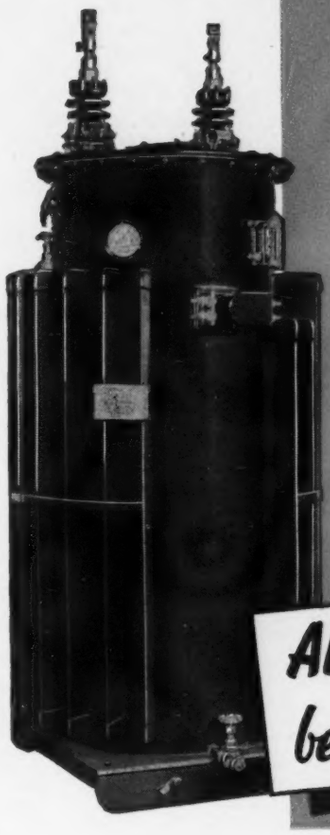
By H. SMITH
Superintendent Elk Mountain Steam-Electric Plant, Carolina Power & Light Company, Asheville, N. C.

Shrink fits, in which the outer part is expanded by heating and slipped over the inner to cause a tight fit when cooled, are commonly used. Expansion fits, in which the inner part is cooled by refrigerants and slipped into the outer and allowed to expand, have been far less common. Until recently the process was expensive and hard to handle. Now we have suitable liquid-air containers, and dry ice can be purchased from most any drug store or dairy. The process is simple and provides a quick

Here's the TRANSFORMER *that* STANDS UP BEST *under*

Voltage Surges
Emergency Overloads
Dust and Dirt

Because it's a liquid-filled transformer . . .



333-kva Pyranol* transformer, rated 60 cycles, 2400/4160 Y volts to 240/480 volts

AND it's free of fire hazard because the liquid is PYRANOL

PYRANOL transformers have all the features that have made liquid-cooled transformers the most nearly trouble-free electric apparatus in service today. For example:

They have high dielectric strength both at normal frequencies and impulse—an important safeguard against damage to the transformers from voltage surges caused by switching operations or by lightning. Immersion of the transformer interior in the Pyranol prevents drying and cracking of the winding insulation, a feature vital to maintenance of the high dielectric strength originally built into the transformer.

The heat-storage capacity inherent in liquid-filled transformers makes Pyranol units ideal for emergency overloads.

The pressure-tight tank protects vital parts of the transformers against damage from moisture, dust, dirt, and sabotage.

Additional Benefits

1. Saving in Copper. Secondary conductors (480 volts) require about 15 times as much copper as equivalent lengths of 4160-volt primary conductors. In a typical, large industrial plant, installation of Pyranol transformers indoors at load centers can save 50 per cent or more on copper—30,000 pounds or more.

2. Saving in Installation Cost. Because Pyranol made possible a vaultless installation of several small transformers indoors (instead of one large transformer outdoors), it brought over-all savings of approximately 20 per cent in the installed cost of a plant distribution system.

3. Saving in Power. Pyranol transformers at load centers reduce copper losses as much as 25 per cent.

Ask your G-E representative for complete information, or write for Bulletin GEA-2048D. *General Electric, Schenectady, N. Y.*

**Pyranol is the G-E trade name for askarel. Pyranol is noninflammable, and no Pyranol transformer has ever burned or contributed to a fire.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

GENERAL ELECTRIC

402-52-5100

and easy way of fitting. It is free from sealing and discoloration. Normally parts that would require heating are large and heavy compared to parts to be inserted. Also, where outer parts have insulation (such as rubber) or paint, heat is likely to cause damage.

Solid carbon dioxide (dry ice) becomes a gas at —110 deg. F., liquid air at —310 deg. F., giving possible cooling ranges from 180 to 380 deg. F., respectively, from a room temperature of 70 deg. F. The diameter of the part is simply multiplied by the factor of expansion for the cooling range. Since it is often difficult to reduce the temperature of the object to be cooled to the temperature of dry ice, a cooling range of 142 deg. F., in the case of dry ice, has been assumed. Thus, a brass bushing 3 in. in diameter will contract 3 × 0.0015 in. = 0.0045 in. when cooled with dry ice from room temperature of 70 deg. F., reducing its diameter to 2.9955 in.

Expansion Fits

The amount of contraction available for expansion fits is ordinarily less than for shrink fits, therefore smaller allowances are required. It has been found from experience with dry ice that good results are usually obtained when, after the inner piece has been fully cooled, a sliding fit is obtained with the outer part. For example, assuming a brass bushing is to be expanded in a 4-in. hole in a casting, to what diameter should the bushing be machined? Answer, 4 × 0.0015 in. = 0.0060 in., less sliding fit allowance of 0.002 in. gives a diameter of 4.004 in. to which the bushing should be machined.

Where a powerful grip is necessary it can be accomplished by heating the outer part—usually in boiling water. This gives a temperature range of 322 deg. F. and 522 deg. F. for dry ice and liquid air, respectively; however, in the case of dry ice a temperature range of 284 deg. F. is assumed for practice. Allowance can be made so that, when the inner piece has been fully cooled and the outer piece heated, a sliding fit is obtained. Suppose it were desirable to fit a hardened steel bushing into a 6-in. hole in a cast-iron bedplate. The expansion of the hole when heated to 212 deg. F. would be 6 × 0.0008 in. = 0.0048 in., giving a diameter of 6.0048 in. The bushing would contract meanwhile 6.0048 × 0.0009 in. = 0.0054 in. This, less the allowance for a sliding fit (0.003 in.) gives a value of 0.0024 in. to be added to the expanded diameter of the hole to get the machining diameter of the bushing—6.0048 + 0.0024 in. = 6.0072 in. Fits of this kind have been made on shaft couplings up to 10 in. diameter with good results. Also, numerous fits where bushings were contracted and allowed to expand in properly machined holes have been entirely satisfactory.

When the inner parts are hollow the same method can be employed to break a fit. The refrigerant can be applied inside and, if done rapidly, the fit may be broken without use of force.

Precautions

There are several precautions that should be observed in doing this work. Remove all grease and oil from the parts to be worked. If using liquid air keep flames away from it. Do not allow refrigerant to come in contact with hands. Handle it as though it were hot. Use parts immediately or they will become frosted. In case the parts do become frosted put them back in the refrigerant until the frost disappears.

Sources of information for allowances for sliding fits, coefficients of expansion in metals, etc., are the U. S. Government Bureau of Standards and the American Standards Association.

Sources of information on expansion and compound fits by refrigerants are Liquid Carbonic Corporation and Dry Ice Corporation.

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Relaying Modernized With Few Changes

By V. D. HOLLIS
Operating Department, Central Illinois Public Service Company, Springfield

Increased loads made it desirable to have high-speed relaying on an outgoing transmission line at a substation where changes in the switchboard were not easily made. Existing phase time-overcurrent, polyphase directional and directional time-overcurrent ground relays were arranged on two panels used for the relays and control of other circuits also, so that space for a complete new set of relays for this circuit would require a major change in the switchboard.

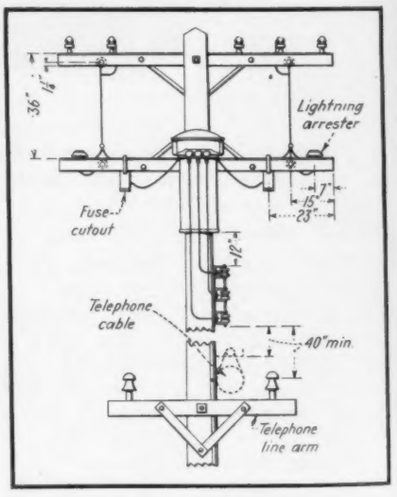
The problem was solved by replacing the polyphase directional relay with voltage restraint and adding a high-speed three-unit impedance relay (size 5½ x 10 in.) and a high-speed induction ground relay (size 5½ x 6 in.). The two added relays provide high-speed protection for faults in the "first zone"; the inverse-time characteristics of the existing overcurrent relays provide the time delay protection for the "intermediate" and "back-up" zones.

•

Transformer Mounting on Joint-Use Poles

Where primary and secondary service pole lines are used jointly by two utility (power and telephone) companies in districts served by the West Penn System, the latter has established mounting arrangements for the equipment.

The accompanying illustration shows the location and spacing required for a transformer installation on the pole. This applies to single-phase transformers rated 50 kva. or smaller for connection to either 2,300 or 4,600 volts primary and to supply 230/115 volts secondary.

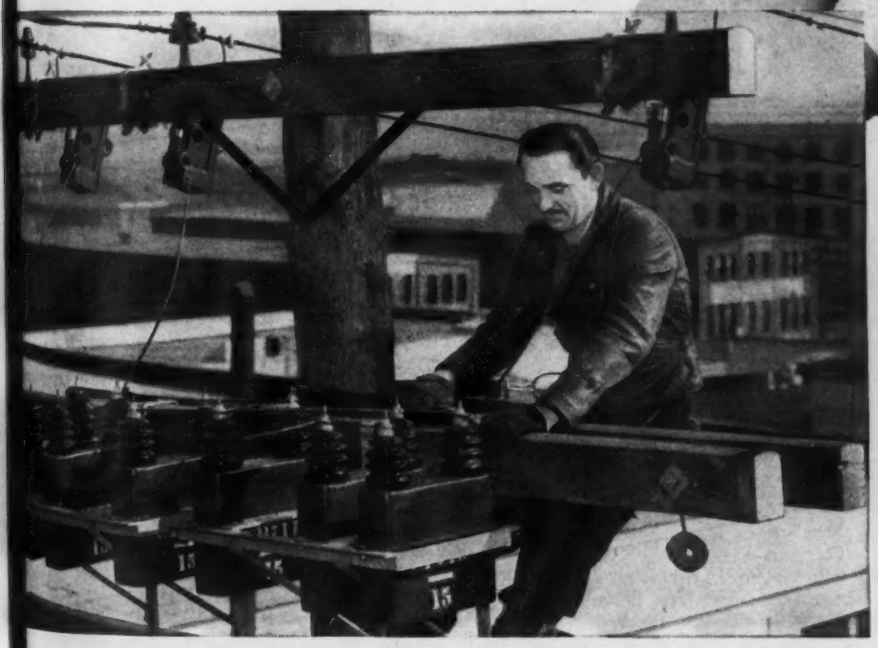


ARRANGEMENT and spacing of power and telephone services on a joint-use pole

It is to be noted that a minimum distance of 40 in. is to be maintained between the lower end of the spool rack and the telephone line arm or telephone cable, whether either one or both are used.

CAPACITORS GIVE "OOMPH" TO A POWER SYSTEM

. . . says the Portland General Electric Company



Ann Sheridan, star of "George Washington Slept Here"

"YOU may not be aware of it," says the Portland General Electric Company to its customers, "but there's probably a shunt capacitor in your life! What's a shunt capacitor? Well, they're made of aluminum foil and heavy paper, which are soaked in oil and enclosed in an airtight steel casing. They give electric lines what Ann Sheridan gives to the movies. When mounted on a pole near your home, they increase and stabilize voltage, which helps assure you of a constant and reliable power supply. Last year, to give 'oomph' to its lines, PGE spent $100,000 for purchase and installation of capacitors."

Ask your G-E representative to tell you how G-E Pyranol capacitors can increase system capacity—with great savings in critical materials. Or, write for descriptive bulletin, GEA-3333. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

407-43-6700

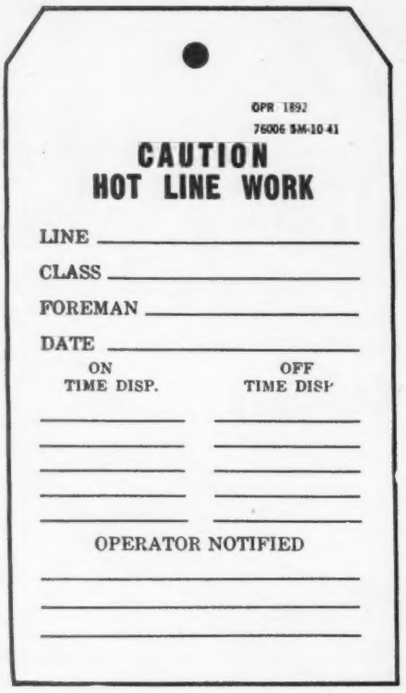
Quotation is from this advertisement of the Portland General Electric Company. It appeared in the April, 1942, issues of *The Oregonian* and the *Oregon Journal*.

SYSTEM PROCEDURES FOR HOT LINE WORK*

HOT LINE TAGS

Before hot line work is started on any line or apparatus a special orange colored tag known, as a hot line tag, must be filled out completely and hung on the dispatching board in a conspicuous place. When a request for a hot line tag has been received the load dispatcher or operator, controlling the line or apparatus, will order the station operator to place hot line tags on switchboard control switches of all oil circuit breakers controlling the line or apparatus. The load dispatcher or operator will then place an amber colored celluloid tag on the dispatching board over each oil switch involved, fill out the hot line tag completely and notify the man that requested hot line tag. Hot line tags placed on control switches will not be removed except on orders of load dispatcher or operator, who ordered tags placed.

If more than one crew is doing hot line work on a line or piece of apparatus the dispatcher or operator will place a hot line tag on his dispatcher's board for each crew that is performing hot line work. However, the station operator will have only one tag on switchboard for the dispatcher or operator. The dispatcher or operator will not order the station operator to remove his hot line tag until all hot line tags have been removed from the dispatcher's board.



Hot line tag

HOT LINE WORK

The foreman in charge of the work must notify the operator or load dispatcher at least three hours in advance that he is to do hot line work on a particular line. When the crew arrives on the job the foreman shall again notify the load dispatcher, who will then place special hot line tags on his board as outlined previously.

Before beginning hot line work on any circuit whose oil circuit breaker is equipped with a reclosing relay or device the recloser must first be made non-operative by opening the "A" switch.

When the hot line work is finished the person in charge of the crew shall report off the line. The hot line tag will then be removed by the load dispatcher or operator, as outlined previously, and the reclosing device on the line breaker made operative.

The four divisions of hot line maintenance and the standard procedure in each case are as follows:

Hot Line Maintenance on Conductors, Insulators, Crossarms and Poles Involving Considerable Work at one Location—In this case the work is performed by a crew which as a rule is not less than six men. It is the duty of the foreman in this case to see that no men except experienced linemen and men familiar with the work are on the job. In all cases there are at least two men on the ground who, in case of emergency, are capable of removing an injured man from the pole or structure. While such work is in progress, a telephone equipped with bells is attached to the telephone line and kept in reach of some member of the crew at all times. The operator must be notified each time when the men actually go on the poles to begin work and when they come off. Hot line tags must be released immediately after work has been completed or when work is to be suspended for more than 15 minutes.

If while hot line work is in progress the line breaker opens automatically, the operator will immediately attempt to communicate with the crew. As soon as crew finds line dead they shall communicate with the operator. In either case, if the crew reports "in-the-clear," the line will be energized immediately. If the crew reports not in the clear the line must be held open for the crew.

If communication is not established between the operator and the crew *the operator will energize line in ten minutes after the automatic opening*. If the line breaker reopens the operator *must* hold line breaker open until communication is established with the crew. The crew will do no further work until communication is established.

Hot Line Maintenance Work on Telephone Lines that are on the same structures with high-tension lines, such as cutting in or out slack, changing arm pins, insulators or ties, or new construction, and there is any chance of the telephone line being pulled up or jumping up into the high-tension lines, the work shall be classed as hot line work. The foreman in charge of such work shall use his best judgment in determining the chance of the telephone line being pulled up or jumping up into the high-tension lines, and if this chance exists, then it shall be worked as set down in the paragraph for "Hot Line Maintenance." The telephone and bells in this case shall be on the line on the station operator side of the work being done.

Testing Insulators Hot is another class of maintenance work which may be classed as "hot line work," if the foreman in charge considers the work hazardous enough to require a hot line tag. The principal difference in case of insulator testing is that the men testing the insulators have no telephone connected to the line at all times. These men, however, carry a test set and call the operator every hour to report their whereabouts, etc. Further, if the line goes dead while these men are testing the insulators and they know that it is dead, they shall at once call in and notify the operator that they are in the clear. This is done merely as a means of cutting down the ten minute intervals and it is distinctly understood that if the operator does not hear from these men he will come back with the line in ten minutes. The tester will on each pole determine whether the line is hot by touching the line with his instrument. If he finds line is dead he will immediately communicate with station operator. In case of failure of communication no more work shall be done until communication has been established.

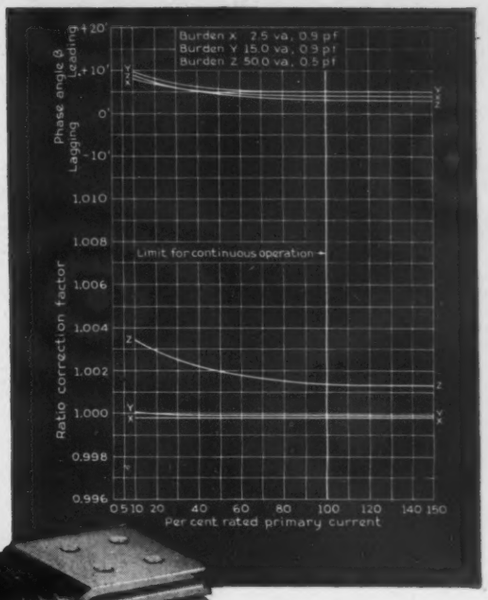
In the case of testing insulators on a tap line where there is no telephone line, the following shall be complied with: The tester shall notify the operator that he is to test such and such a tap line. He shall determine on each pole whether the line is hot by touching the conductor with his instrument. In case he finds the line dead he shall communicate with the station operator as soon as possible, and do no more work until he has. Unless otherwise instructed, the station operator will make the line hot after ten minutes.

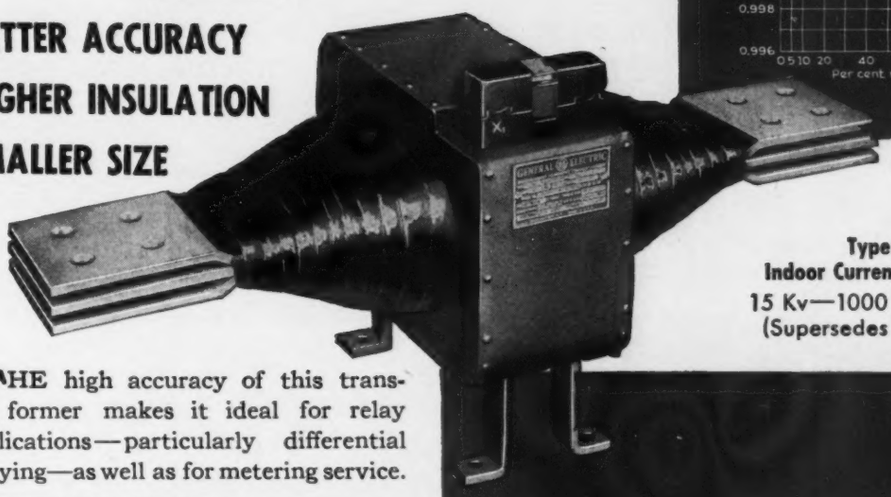
Work Done in Dangerous Proximity to Hot Equipment on multiple circuit lines or at generating plants, primary and secondary substations shall be treated the same as hot line work if there is any chance of workmen accidentally coming in contact with hot equipment. The foreman in charge of such work shall use his best judgment in determining the hazard involved, and if a hazard exists, then the regular procedure for "Hot Line Maintenance" shall be followed as previously set forth.

*According to system operating procedures of Alabama Power Company.

Improved in 3 ways

1. **BETTER ACCURACY**
2. **HIGHER INSULATION**
3. **SMALLER SIZE**





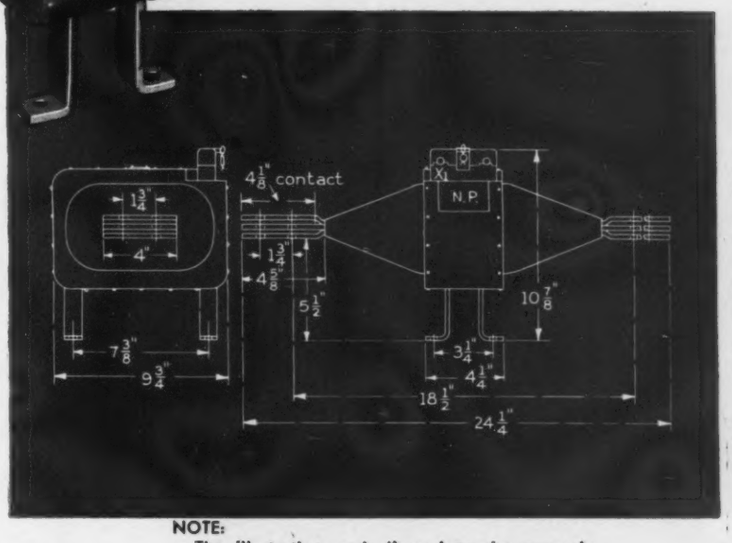
Type JK-9
Indoor Current Transformer
15 Kv—1000 to 4000 Amp
(Supersedes Type KC-51)

THE high accuracy of this transformer makes it ideal for relay applications—particularly differential relaying—as well as for metering service.

ACCURACY—During overcurrent conditions, with a burden Z, all ratings will be within eight per cent of the true ratio at 20 times normal current. The metering-service accuracy classification of these transformers is: 1000- and 1200-amp, ¼X, ¼Y, and ½Z; 1500- to 4000-amp, ¼X, ¼Y, and ¼Z.

INSULATION—The impulse strength meets the test requirements for 95 kv, full-wave, on both insulation and flashover (ASA standard for 15-kv instrument transformers).

SIZE—The JK-9 is six inches shorter than the KC-51, therefore requires less mounting space.



NOTE:
The illustration and dimensions shown apply specifically to the 3000-amp rating. The accuracy curve covers ratings from 1500 to 4000 amperes.

A COMPLETE LINE

You can adopt G-E instrument transformers as standard throughout your system, for General Electric makes a complete line—indoor and outdoor, current and potential, and portable.

For additional information about the JK-9, ask for Bulletin GEA-3876. Your G-E office has copies, or write to General Electric, Schenectady, New York.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

GENERAL ELECTRIC

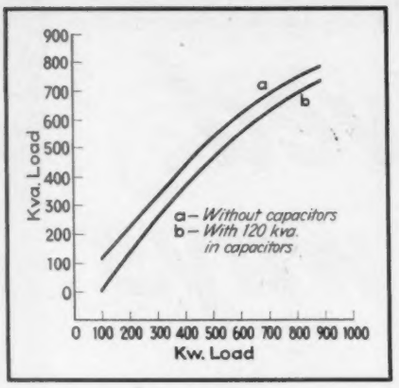
804-8-8400

Capacitors Improve Generator Service

Poor power-factor conditions in a small Eastern central station with four fuel-driven generating units aggregating 2,098 kva. led to an investigation of the possibilities of correction with the objective of securing a better allocation of service use among these sets. The four units were rated at 294, 429, 625 and 750 kva., and while driven by Diesel engines, provided a case for power-factor improvement capable of wider application.

In a representative day's run the load on the plant varied from 230 to 730 kw., and the power-factor at the station bus ranged between 63 and 91 percent. From midnight to 5 a.m. the output varied from 230 minimum to 265 kw. and the power-factor from 63 to 68 percent; from 6 a.m. to 3 p.m. the load range was between 300 and 540 kw. and the power-factor variation between 72 and 78 percent. With 600 kw. output at 4 p.m. the power factor was 85 percent, and at the evening peak, 7 p.m., the load was 730 kw. and the power factor 91 percent. During the evening the load gradually dropped to 350 kw. and the power factor fell to 76 percent.

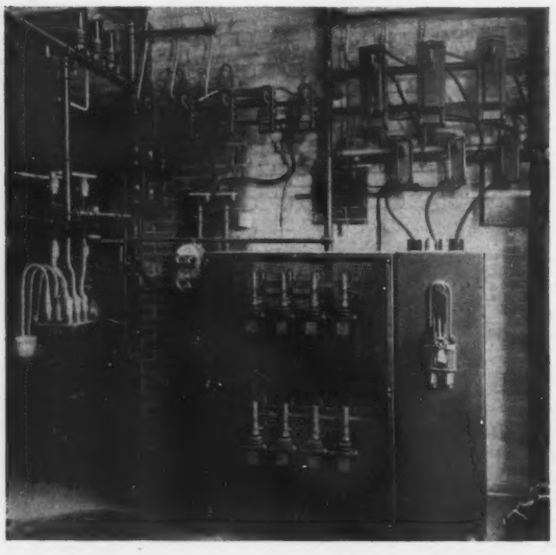
A chart was prepared showing the kva. load obtained for any given kw. load from 100 to 800 kw. without correction (curve a, above), and the kva. load obtainable for a given kw. load when 120 kva. in capacitors was installed (curve b). These values enabled the utility plant to determine readily the kw. load possible to carry with each of the four generators in the station after the capacitor installation was made. Thus, without capacitors, the 294-kva. generator could carry a maximum load or not over 170 kw., because without such correction the 170-kw. load would represent about 290 kva. With 120 kva. in capacitors on the station bus, this generator, in order to be fully loaded with 290 kva., will carry a maximum load of 240 kw.



KVA. OUTPUTS obtainable (a) before and (b) after installing 120 kva. in corrective equipment at station, for various kw. loads

The three other generators can likewise carry proportionately larger loads when the power factor is corrected. Eight 15-kva. capacitor units were installed at the bus, with provision for switching on or off when desired, and screen protection as illustrated. The operation of extra units to provide wattless current with consequent heating has been overcome at relatively small cost, permitting the plant to get much greater benefit from the rated capacity of the several installed generating sets. The 120-kva. capacitor installation was made in preference to a 90-kva. layout because increased correction could be had with the larger group at relatively small cost increase.

In this investigation the question of using the power-factor correction capacitors also for lightning surge protection as each generator came up, and it was found that for the particular installation, it would be inadvisable to do this. The proposed plan would have called for a special voltage capacitor at higher cost than standard units, and the better protection appeared to be obtainable by equipping each generator at its terminals with a small three-phase grounded neutral capacitor. This, in turn, would avoid telephone interference hazards which might arise from setting up high capacity capacitors for lightning surge protection.



CAPACITOR BANK in generating plant increases usefulness of existing units

•

Installing Iron Wire for Line Conductors

Instructions covering the use of galvanized iron wire — sometimes called steel wire — for use as line conductors have been prepared by a Western utility. Based on the instructions, the following information applies to galvanized grade BB solid (B.W.G.) and to ordinary galvanized seven-wire ¼-in. strand.

Splices—For iron to iron splices on No. 8 and No. 9 conductors standard telephone splices are to be used. It is doubtful if sleeves will be available for rolled sleeve splices, therefore the three-wire splice will suffice. For ¼-in. galvanized steel strand the splice to be used is shown in the accompanying sketch.

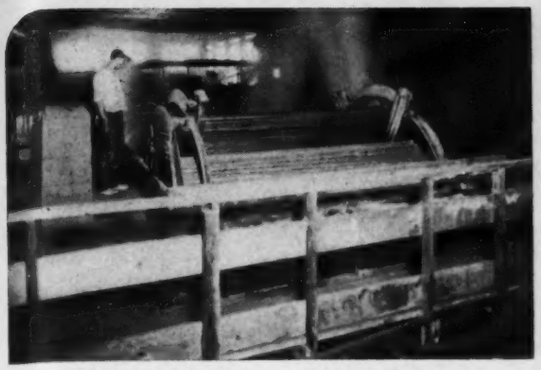
Tie Wires—Use No. 9 iron tie on sizes No. 8 and No. 9 iron and No. 8 iron for ¼-in. galvanized strand conductor.

Splicing of Conductors of Different Metals—Where copper and iron conductors are to be joined to each other, the connection must be made in such a manner that the joint will be under no strain. The line conductors shall be dead-ended and a jumper connection made across the two dead-ends, or a strain insulator may be installed close to a crossarm and each different type of conductor dead-ended on the insulator with a jumper connection between the two different sections.

Under no condition should line conductors of two different materials be spliced to each other in a span.

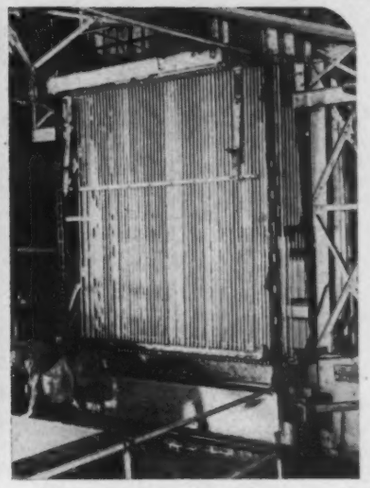
Connectors — For copper to iron connection, where size permits and if stock is available, use Kearney solderless connector, Catalogue No. 6765-2, in accordance with good telephone practice.

Strength and Weights—Comparative strengths and weights for copper

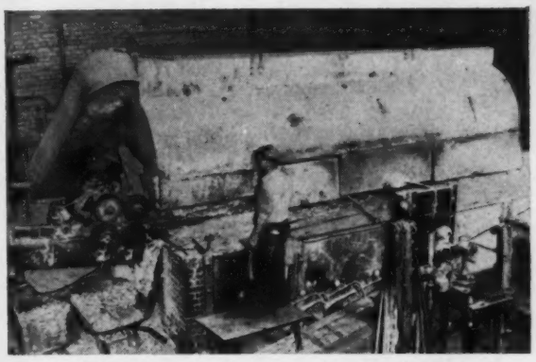


G-E Conduit in exclusive G-E "Pickling" machine

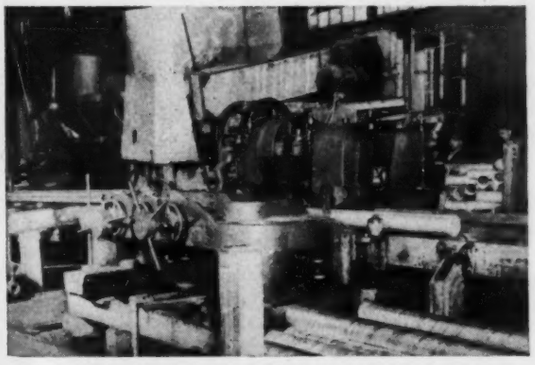
G-E Black leaving enamel tank



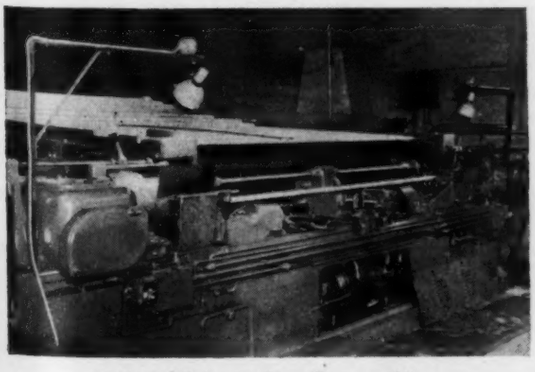
G-E White entering Glyptal tank



G-E White leaving hot-dipped galvanizing tank



G-E White moving through straightening machine



G-E Conduit on threading machine

Processes Behind G-E CONDUIT Provide High Quality

No. 9 Concluding Ad of a Series
Men and Processes Behind G-E Conduit

G-E Rigid Conduit is designed and made to give wiring systems the utmost protection. Both G-E White and G-E Black are made from easy bending, open hearth steel tubing expertly processed by skilled, experienced workmen. The hot-dipped galvanizing of the tube for G-E White and the tough, elastic enamelling for G-E Black make each a leader in its class.

Craftsmen, proud of their work, handle all processes in the manufacture of G-E Conduit. The processes themselves have been developed through long experience and research. The pickling, the enamelling of G-E Black and the hot-dipped galvanizing, the straightening, the Glyptal coating of G-E White and the threading . . . all are modern processes which produce the finest conduit. Only the best of new materials are used. Detailed specifications are accurately met. Inspections are made daily of equipment, processes and materials.

For further information about G-E Conduit see the nearest G-E Merchandise Distributor or write to Section C1121-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

FANNED SPLICE for ¼-in. galvanized steel strand used for line conductor. To make the splice: (1) Separate and "fan out" the seven individual wires a distance of 11 in. on the end of each cable. (2) Bring the cables together concentrically with the "fanned" wires of each cable laid alternately between the "fanned" wires of the other. (3) Smooth down the ends against the cables. (4) Serve one wire from each cable seven or eight turns around its six companion wires and the other cable. (5) Then serve each of the other wires, in turn, in a like manner. (6) "Nick," pull down and break off the end of each wire as the serving is completed; then hammer the ends down smooth.

and iron conductors for equivalent use are given in the following table:

Conductor	Ultimate Tensile Strength, Lb.	Weight per 1,000 Ft., Lb.
No. 4 MHD Copper—Stranded	1,940	126.5
No. 6 MHD Copper—Solid	1,046	79.5
No. 6 BB Iron—Solid	1,650	112
No. 8 BB Iron—Solid	1,090	74
No. 9 BB Iron—Solid	880	60
¼-in. Common—7-wire strand (steel)	1,900	130

Voltage drop tables for various voltage classifications, also information relative to sizes and sags for iron wire, were presented in November 14, 1942, issue, page 101, of ELECTRICAL WORLD.

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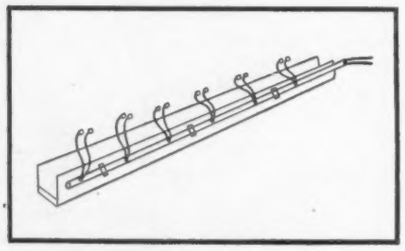
Unfreezing Bearings of Register Motors

Gummy oil can impose a stalling load on the type B7 motors used in demand meter registers and that condition is often found in registers brought into the meter shop for attention. The way to eliminate the deteriorated oil is to dissolve it in new oil. The accompanying sketch shows how this is done in the meter



TROUGH for flushing out bearings of demand register motors

repair shop of the Philadelphia Electric Company.

A metal trough about 18 in. long and with sides 3 in. high has a fibre tube fastened along one side. This tube incloses a pair of potential leads from which taps are brought out through six evenly spaced holes. The taps end in connectors to fit the motor terminals. The motors are laid across the top of the trough with the outboard shaft projecting downward. The caps having been removed, the rotors are completely filled with oil and the motors energized. As the oil works through, the rotor and gear bearings loosen up and soon the motors are spinning freely. It may take two or three fillings of oil to free the bearings so that a motor will give a satisfactory torque check.

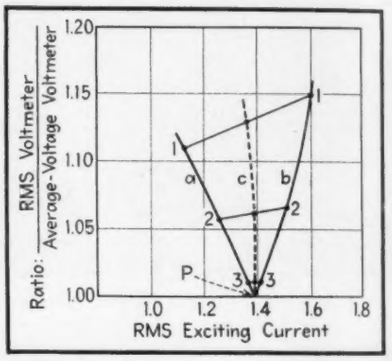
•

Correcting Values of Exciting Current

In an article entitled "The Average-Voltage Voltmeter," by F. K. Dalton, testing engineer of the Hydro-Electric Power Commission of Ontario, and published in *Electrical News and Engineering* (Canada) for July, 1942, the author describes a new method for correcting transformer exciting currents where the applied voltage waves are not of the sine form. The simplicity and practicability of the method are evident, and it appreciably shortens the time necessary for routine testing where such corrections are desired.

This method requires the use of the r.m.s. and average-voltage voltmeters together, the latter being calibrated to agree with the former on a pure sine wave. Voltage is applied to the transformer terminals and adjusted first to normal value by the r.m.s. voltmeter. Exciting current is read on an r.m.s. ammeter. The applied voltage then is adjusted to normal by the average-voltage voltmeter and the exciting current again is read on the same ammeter. The average of the two ammeter readings is the correct value of exciting current, an exceedingly close approximation to the value that would be obtained with a pure sine wave of voltage. In this test the voltage must be varied by generator field control, induction regulator or series reactance, but not by series resistance.

In the test results plotted in the accompanying graph readings were taken in pairs with different wave forms of voltage and the average value for each pair of readings is shown. The curve marked "C" passes through these points, and it will be seen that for a considerable range of voltage distortion from the sine wave the dotted line is practically straight and vertical. This, therefore, verifies the accuracy of the new method for determining true values of exciting current of transformers within a reasonable range of voltage wave form



EXCITING current curves of a 200-kva., single-phase transformer with different wave forms of voltage

Wave form changed by series reactance. Adjustment of voltage: Curve *a* by r.m.s. voltmeter; curve *b* by average-voltage voltmeter. Curve c is average values of exciting currents.

variations. In using this method, the following advantages are apparent:

1. Only one additional test instrument is required.
2. Only one extra reading is necessary for correction of exciting current at any chosen voltage.
3. Voltage wave is used as received without variation of form being necessary as is required in other recommended methods.
4. Plotting of readings is not required.
5. Accuracy good; better than those methods requiring determination of true exciting currents by means of graphs.

This is a new application of the average-voltage voltmeter, which already has been found a very useful and desirable instrument on the electrical test floor. The author's use of the voltmeter for transformer core loss correction is presented in the November 14, 1942, issue, page 114, of ELECTRICAL WORLD.

What the clock manufacturers are making would alarm Hitler

Alarms and other clocks may not be as plentiful as they once were . . . although it is believed there will be enough for every war worker. But fewer clocks, and fewer everything for civilians, is good news for Americans because it is the worst of news for Hitler.

In converting production facilities from clocks to war essentials, manufacturers were able to overcome new problems easily and quickly in cooperation with the Revere Technical Advisory staff. For in all problems of copper and its alloys, Revere supplies a service, in addition to sound metals, that helps untie the knots of processing and fabrication.

Every ounce of copper our country can produce goes directly into war essentials. Fortunately, Revere is well equipped, with modern plants, improved machines and advanced techniques, to assume a heavy responsibility in meeting critical needs. And Revere research is continually uncovering new knowledge about copper to help make our arms more swift and sure.

The Revere Technical Advisory Service functions in (1) developing new and better Revere materials to meet active or anticipated demands; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; (3) continuously observing developments of science and engineering for their utilization in production methods and equipment; (4) helping industrial executives make use of data thus developed. This service is available to you, free.

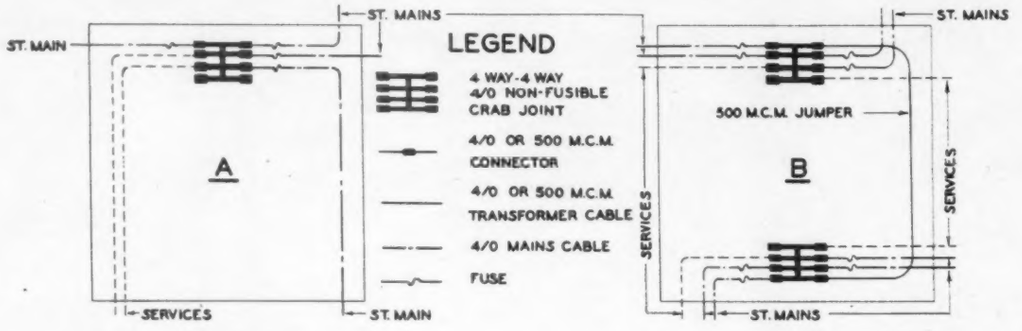
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK

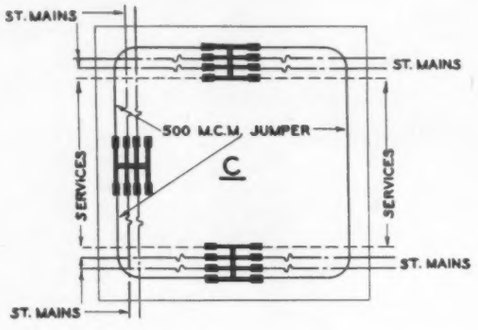
HOW TO MAKE
SERVICE CONNECTIONS
WITH NON-FUSIBLE CRAB JOINTS*

When transformer cables are to be connected refer to sketches A_1 B_1 and C_1

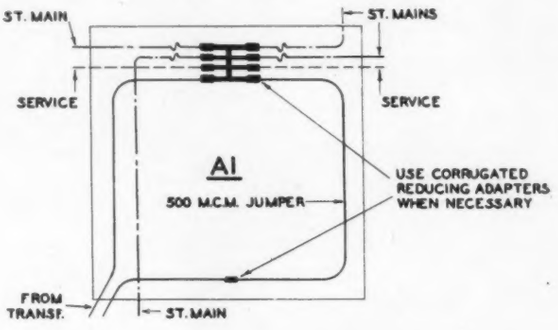


A- TOTAL NUMBER OF CABLE ENDS PER PHASE "MAINS" AND SERVICES, 6 OR LESS

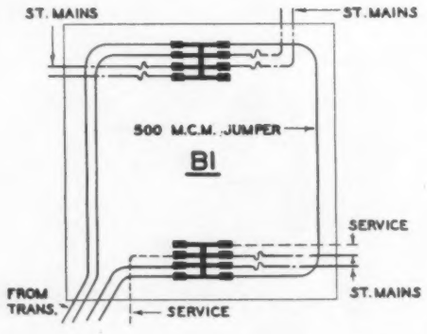
B. TOTAL NUMBER OF CABLE ENDS PER PHASE "MAINS" AND SERVICES, 7 TO 12



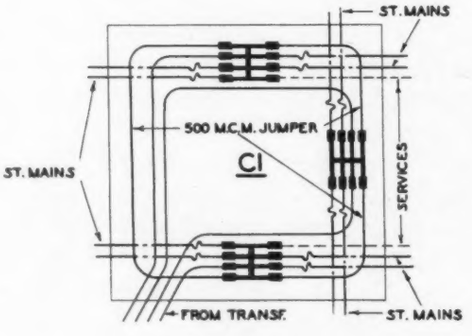
C- TOTAL NUMBER OF CABLE ENDS PER PHASE "MAINS" AND SERVICES 13 TO 18



AI -TOTAL NUMBER OF "MAINS" AND SERVICE CABLE ENDS PER PHASE 6 OR LESS TWO TRANSFORMER CABLE PER PHASE



BI- 7 OR 8 MAINS AND SERVICE CABLE END PER PHASE FOUR TRANSFORMER CABLES PER PHASE



CI-9 TO 14 MAINS AND SERVICE CABLE ENDS PER PHASE FOUR TRANSFORMER CABLES PER PHASE

NOTES

1. These drawings are schematic only. Location of splices depends on racking conditions in each case.

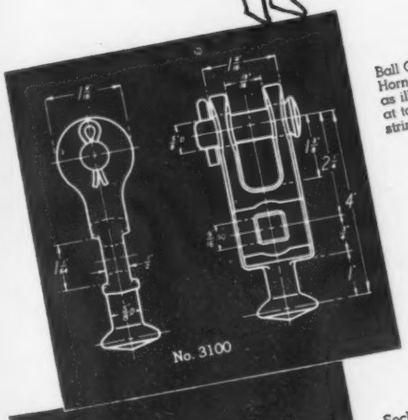
2. One phase only is shown.

3. Single-phase loads should be balanced on the three phases in each manhole.

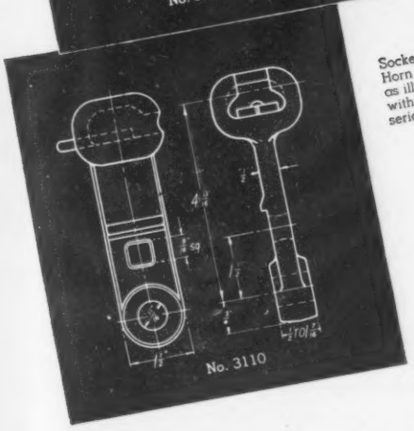
* From Underground Distribution Standards of Western Massachusetts Companies

DESIGNING A TRANSMISSION LINE?

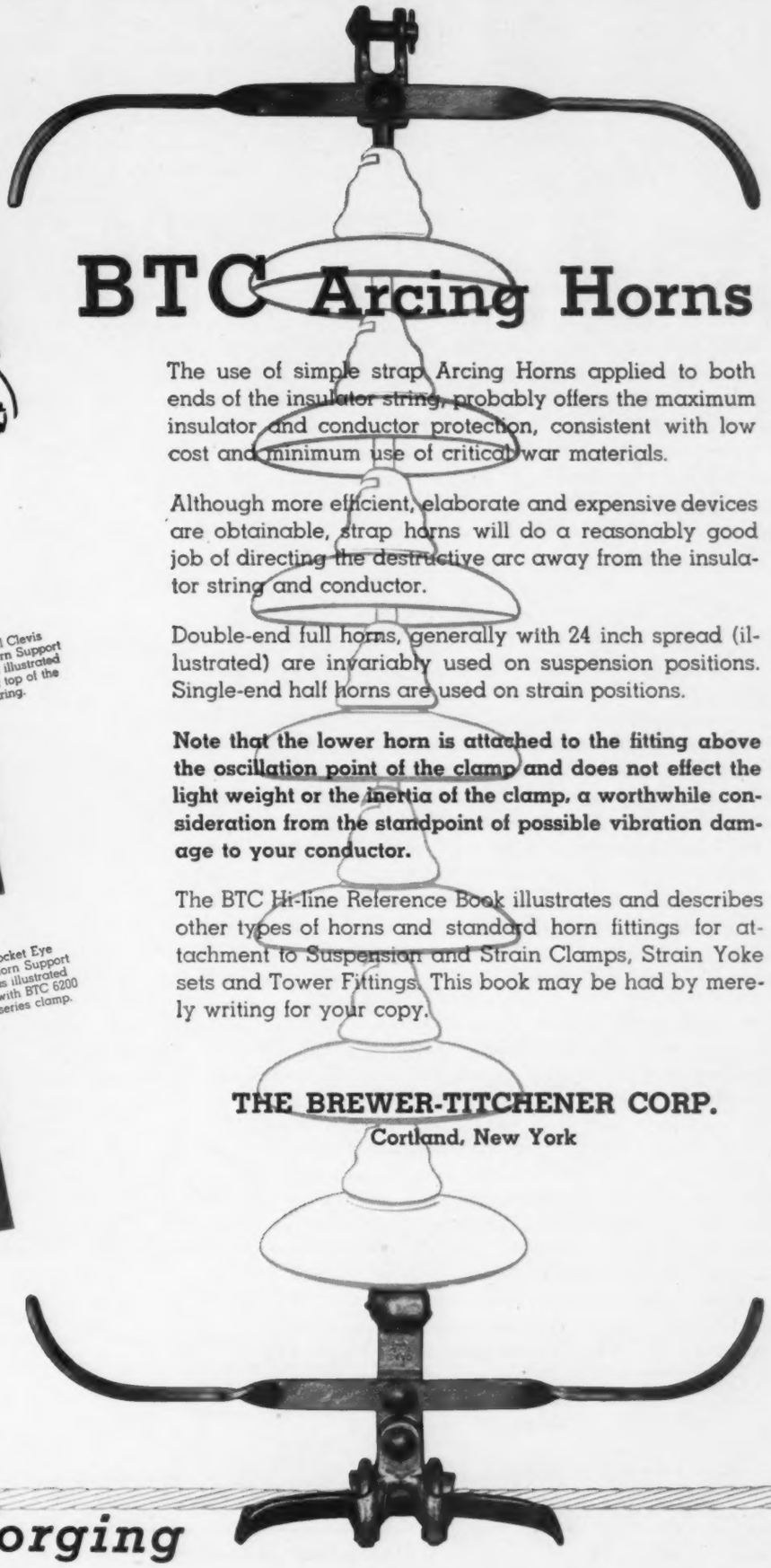
When Thinking About Protective Devices, Consider



Ball Clevis Horn Support as illustrated at top of the string.



Socket Eye Horn Support as illustrated with BTC 6200 series clamp.



BTC Arcing Horns

The use of simple strap Arcing Horns applied to both ends of the insulator string, probably offers the maximum insulator and conductor protection, consistent with low cost and minimum use of critical war materials.

Although more efficient, elaborate and expensive devices are obtainable, strap horns will do a reasonably good job of directing the destructive arc away from the insulator string and conductor.

Double-end full horns, generally with 24 inch spread (illustrated) are invariably used on suspension positions. Single-end half horns are used on strain positions.

Note that the lower horn is attached to the fitting above the oscillation point of the clamp and does not effect the light weight or the inertia of the clamp, a worthwhile consideration from the standpoint of possible vibration damage to your conductor.

The BTC Hi-line Reference Book illustrates and describes other types of horns and standard horn fittings for attachment to Suspension and Strain Clamps, Strain Yoke sets and Tower Fittings. This book may be had by merely writing for your copy.

THE BREWER-TITCHENER CORP.
Cortland, New York

BTC

Specify a forging

Maintenance of Insulating Oil

III. Fibers, Dust, Moisture*

By L. M. LIMPUS
Superintendent of Reclamation,
Oklahoma Gas & Electric Company

Moisture deteriorates the dielectric properties of the solid and liquid insulations and, combining with the acidic vapors, produces corrosion. Dust, fibers and similar contaminants absorb moisture and oxygen at or near the surface of the oil and transfer them to the internal fibrous and cellulose insulations, while, at the same time, acting as catalysts to materially increase the rate of oil oxidation. These contaminants are generally discovered in dangerous concentrations by the standard dielectric test, or by actual separation from the insulating liquid in an efficient laboratory centrifuge which measures the contaminant in percent of sample volume.

Minimum dielectric test value for insulating oil from service in transformers, regulators, oil circuit breakers and associated oil-filled apparatus is established at approximately 17,000 volts breakdown between 1 in. flat disk electrodes, spaced $\frac{1}{10}$ in. apart, in a standard oil test cup. Slight deviation from the standard procedure as outlined in all instruction books† for the procurement of samples and the determination of the dielectric strength may readily render this test totally erroneous. A practical suggestion here is for absolute cleanliness of sampling and testing apparatus and using the average test of two test-cup fillings (five break-downs per filling) as the approximate voltage test for routine service tests. Opening a sample jar containing a sample of insulating oil, before the jar and contents have reached the approximate temperature of the room and test cup, may result in sufficient condensation to give a very low test value to a perfectly dry oil; also failure to close immediately the sample container after obtaining the oil sample, may permit the entrance of a sufficient amount of dust to distort seriously the true test value of oil being investigated.

Consistently low dielectric test does not always prove the existence of moisture, as fibers, dust, carbon and other conducting contaminants also produce low readings. Dissolved moisture, possibly not in evidence at the higher operating temperatures, is not discoverable by this test unless the sample is permitted to cool to a temperature of about 40 deg. C. As moisture, water, fibers dust and other similar contaminating particles are readily removed in centrifuge, blotter press or other mechanical separator, and if such contaminants are the only offenders, this form of purification is recommended. If there is an appreciable amount of contamination, especially in the case of moisture and water, centrifuging appears to be the most economical means of purification. However, adequate control over the water-soluble characteristic of insulating oils must be exercised during the reconditioning process regardless of the type of separator used.

If purification is attempted at elevated temperatures, the oil will readily dissolve large quantities of moisture, as much as 200 parts per million at 90 deg. C., and this dissolved moisture is not removed by any form of mechanical separation, but it is precipitated out of solution when the temperature is again returned to normal, retaining only about 10 parts per million at 20 deg. C. Oils so filtered at temperatures in excess of 50 deg. C. will show a high dielectric strength as they pass from the filter and a much lower test value upon cooling. A recommended temperature for the centrifuge and blotter press is 30 deg. C., which may be slightly lowered for some transformer oils and increased to 35 deg. for some highly carbonized switch oils.

When contemplating the removal of such contaminants by mechanical extraction it is well to remember that this form of filtration as generally practiced in the past (wherein the oil is removed from the bottom of the tank, passed through the filter, and returned to either the top or the bottom), will not provide sufficient agitation within the tank to dislodge concentrations of these contaminants. Such concentrations will lie dormant in obscure recesses, or will adhere tenaciously to the tank walls and core assembly, eventually giving trouble when the apparatus is considered free from such contamination.

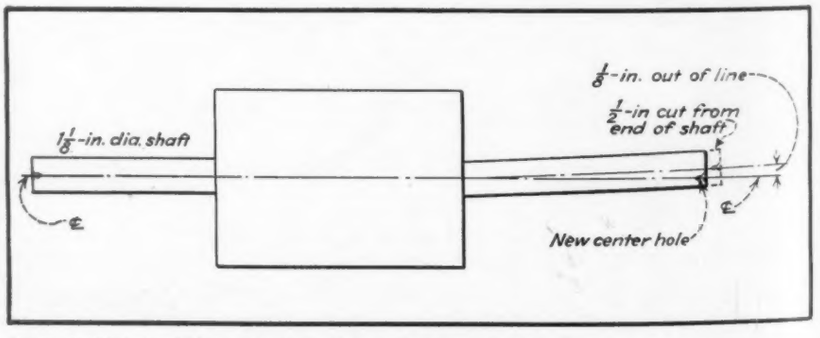
If at all possible, the apparatus should be removed from service and the oil passed through the filter into another tank, or drums, thus forcing all of the oil through the filter and permitting a visual inspection of the interior of the apparatus for these concentrations. This method of filtration is highly efficient, whereas "circulation within its own tank" is at best a very slow, tedious process, involving a much larger expenditure of labor. "Circulation" is recommended only for the purpose of improving the dielectric strength of an oil weakened by the presence of free moisture.

•

Motor Shaft Trued by Spray Metallizing

The spray metallizing process was used in an unusual manner in a midwestern plant recently to straighten out the shaft of a 3-hp. two-speed motor which drives crusher rolls through speed-reduction mechanism.

Shaft of this motor was bent out of line at one end when the mechanism became jammed during operation. No equipment was available at the plant to press the rotor off the motor shaft and straighten it by conventional methods. It remained either to return the rotor to the factory, at the cost of considerable delay, or to find



BENT SHAFT of clinker grinder motor trued by metallizing

*This series began in the October 31 issue of "Electrical World."

†Detailed instructions for this procedure are contained in Westinghouse Instruction Book IB 5336-C, General Electric Company Bulletin No. 49709, or Allis-Chalmers Instruction Book No. X5106A, and ASTM No. D117-27.

KAPPA COIL WINDING TAPES

(CELLULOSE ACETATE)

KAPPA Coil Winding Tapes are an entirely NEW and superior product based on extensive research in the development of modern cellulose acetate fabrics for this specialized application ... and available for IMMEDIATE DELIVERY in any quantity.

- HIGH DIELECTRIC
- LOW POWER FACTOR
- ECONOMY IN VARNISHING
- LOW MOISTURE ABSORPTION
- FAST DRYING
- HIGH DRY TENSILE STRENGTH
- LOW COST

IMMEDIATELY AVAILABLE IN ANY QUANTITY
standard tape widths and mil thicknesses, also special widths

On every one of the seven counts listed in the panel to the left, KAPPA Tapes have shown important advantages over present standard coil winding materials. Tests in actual use have demonstrated that KAPPA Tapes handle better in both machine and hand taping operations, and that KAPPA-taped coils are smoother and the varnish application more uniform. Furthermore, the higher dielectric breakdown values of this new material have made it possible to secure equivalent insulation efficiency with less varnish or fewer dips than previous standard material.

We will be glad to send you detailed test data covering all of these points and to enter your name for a copy of the new KAPPA Technical Bulletin now on the press. Write direct to Wm. E. Wright & Sons Company, Industrial Textile Division, Box 1000, West Warren, Mass.

The Wright tape for every winding.. KAPPA

a way to straighten the shaft with the rotor in place.

As shown in the accompanying sketch, the 1⅛-in. shaft was about $\frac{1}{16}$ to $\frac{1}{8}$ in. out of line at one end. The bend was between the rotor and the end of the shaft. To make the repair, the true end of the shaft was chucked up in a lathe so that the rotor turned on its true axis. About $\frac{1}{2}$ in. was cut from the out-of-line end of the shaft and a new "center hole" drilled which was in line with the center hole on the opposite end of the shaft.

With the shaft turning in the lathe the high side of the shaft on the out-of-line end was turned down. The surface was roughened up and enough metal sprayed on to build up the low side. This built up portion of the shaft was then turned to size and the rotor restored to the motor. This repair was entirely satisfactory and the motor is now in regular operation.

•

Compressibility of Composition Cork—II

By L. P. HART, Jr.
Works Laboratory, General Electric Company, Pittsfield, Mass.

For resinous-bonded composition cork used as gasket material on liquid-filled electrical equipment, the determination of static and dynamic compressibility was presented in ELECTRICAL WORLD, November 14, 1942, page 104.

Compressibility characteristics may be calculated with reasonable accuracy from density measurements on a Jolly balance. Relation between dynamic compressibility (D in pounds per square inch) and density (x in pounds per cubic foot) is expressed by a curve of the type $Y = a + bx + cx^2$, and may be represented by an equation such as

$$D = 1695 - 163.4\,x + 4.47\,x^3 \qquad (2)$$

Relation between static compressibility (S) and density is determined by using formulas (1) and (2) and solving for S, which is

$$S = \log_{10}^{-1}\,(0.983 + 8.7 \times 10^{-2}\,x - 2.39 \times 10^{-3}\,x^2) \qquad (3)$$

Constants in formulas (2) and (3) will vary according to the amounts of plasticizer and binder used in the different compositions.

Composition cork has been found to function best as gasket material when it is compressed so that its density is between 55 and 65 psi.

A change in relative humidity (between 5 and 85 percent) causes changes in dimensions, weight and compressibility characteristics and density, which values can be calculated.

Dimensional changes, found to be practically the same in each direction, can be determined by the formula:

$$Y = 0.015\,H \qquad (4)$$

where Y is percent dimensional increase over that at 0 percent relative humidity and H is percent relative humidity.

Average weight change on exposures to various constant relative humidities in the range 36 to 74 percent for 48-hour increments may be represented by the equation:

$$p = 0.14H - 3.7 \qquad (5)$$

where p is percent of weight increase over that at 0 percent relative humidity and H is percent humidity increase over that at 0 percent relative humidity.

By further calculations for relation between density and relative humidity, it has been determined that a change of 10 percent in relative humidity should be accompanied by a change of 1 percent in density.

Static compressibility change with change in relative humidity can be determined by the formula:

$$S_{H2} = S_{H1} - 16.2\,(\log_{10} H_1 - \log_{10} H_2) \qquad (6)$$

where S_{H2} and S_{H1} are static compressibilities at respective percent relative humidities H_1 and H_2.

Dynamic compressibility change with change in relative humidity can be calculated by the formula:

$$D_2 = \frac{D_1 + [\log_{10} 16.2\,(\log H_1 - \log H_2)]}{5.34} \times 10^4 \qquad (7)$$

where D_2 and D_1 are dynamic compressibilities at percent relative humidities H_2 and H_1, respectively.

Results obtained with the foregoing formulas could be used for design purposes and as checks on future lots composed of the same ingredients in the same ratios.

For a quick test on incoming shipments of composition cork, compressibility determination cannot be used as a criterion unless samples are conditioned to some standard humidity, and because the procedure requires as many as five days it is not a practical method.

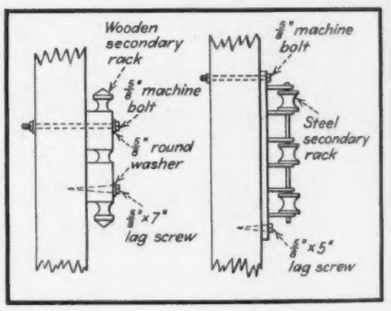
However, density variations are never more than 1 percent per 10 percent change in relative humidity. Thus, if a density range is established at 50 percent relative humidity, and if 5 percent is added to this in each direction, density determinations may be used as a control instrument.

•

Old Crossarms Make New Secondary Racks

Solid wood remaining in crossarms that are retired from service is being put to good use by the Wisconsin Electric Power Company, Milwaukee, in making crossarm braces, secondary racks and guy guards to take the place of similar metal fixtures. On the basis of 1941 use, this substitution of wood for steel would result in an annual saving of 45,000 lb. of steel, company engineers estimate. However, in view of the restrictions on overhead construction work due to the war, the saving is now considerably less. It is still a sizable item, however.

Most unique substitution is that of wood for the conventional metal and



ALL-WOOD secondary rack (left) turned from solid wood remaining in old crossarms saves 6¼ lb. of steel used in the conventional rack room shown, at right

porcelain secondary rack. The accompanying sketch shows a wooden rack made up from a portion of crossarm. The wood is turned down in a lathe as required to make the spools for the wires. Comparison with a conventional metal rack with porcelain knobs is possible in the illustration.

The wooden rack is dipped in creosote to preserve the wood as long as possible. Thus far 152 of these wooden racks have been installed on the Milwaukee system. They seem to be entirely satisfactory in service, the company reports, and it is believed that they will last for a good many years. Each rack saves 6¼ lb. of steel.

Guard YOUR turbines with this oil that's

FIGHTING with the FLAT-TOPS

FROM THE LAND "DOWN UNDER" to the fog-bound north the mighty turbines in scores of U. S. Naval units are being lubricated by new, rust-preventive Shell Turbo Oil.

These turbines run under a wide variety of loads. The oil, which is constantly in contact with air and, frequently, water, must lubricate bearings, gears, governor. It's one of the toughest turbine lubrication assignments there is. But new, rust-preventive Shell Turbo Oil can handle it.

The secret is in the fact that it has *all* 3 vital requirements necessary to the proper lubrication of modern turbines:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Call in the Shell man now. Let him show you why it will pay you to use the new Shell Turbo Oil.

RUST-PREVENTIVE

SHELL TURBO OIL

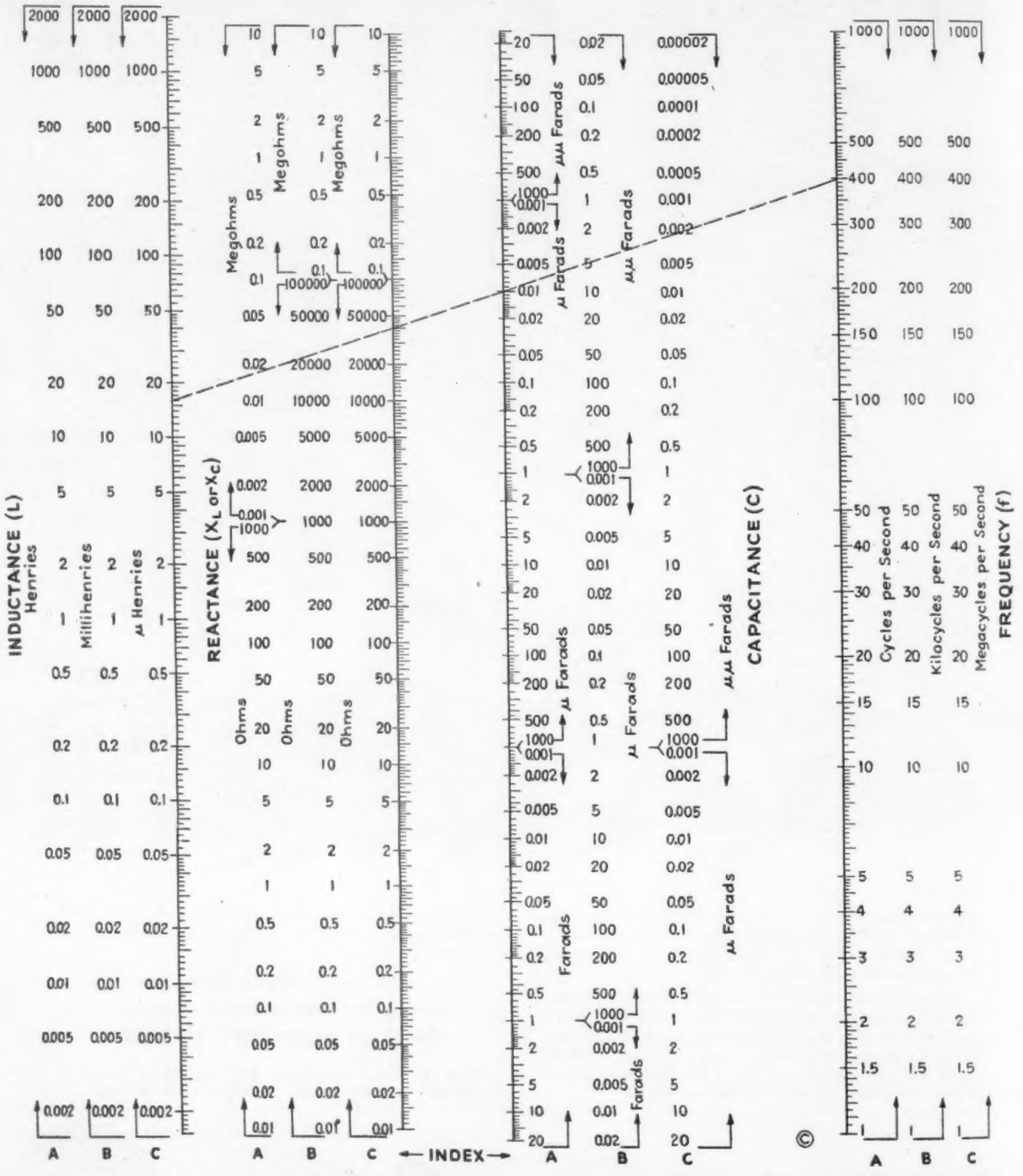
A name to Remember

OIL IS *Ammunition* -USE IT WISELY

SHELL

HOW TO DETERMINE REACTANCE FOR ELECTRONIC CIRCUITS

By this reactance chart conversions are readily made for reactance offered by inductances or capacitances within the frequency range from 1 cycle per second to 1,000 megacycles per second. This chart is produced from materials furnished by Sylvania Electric Products Inc., Emporium, Pa.



INSTRUCTIONS FOR USE OF CHART

Use corresponding indices for each scale; that is, if values in index A are used for the inductance scale, then values in indices A are used for reactance, capacitance and frequency scales.

Example—To determine the reactance of a 0.01-mfd. condenser at a frequency of 400 cycles per second place a straight edge across the chart so as to connect the points 0.01 mfd. and 400 cycles, using values indicated in indices A. At the point of intersection on the reactance scale read 40,000 ohms. Also at the point of intersection on the inductance scale read 15.8 henries, indicating that this value of inductance likewise has a reactance of 40,000 ohms at 400 cycles and, furthermore, that these values of capacitance and inductance produce resonance at this frequency.

INSULATED WIRES & CABLES *Must* CARRY EMERGENCY OVERLOADS

Specifications for insulated wires and cables usually provide for carrying the expected load with ample reserve capacity for occasional overload; for standing up for a reasonable time under voltage surges much higher than normal operating voltage; for having other properties well in excess of what may be needed to meet any demand likely to occur during installation or while in service. When buying equipment of any sort it is good engineering practice to provide extra capacity to take care of the overloads that will come sooner or later. All these excess values provide a factor of safety to meet the abnormal demands that come with emergency conditions.

War is an emergency. Industry is called upon to make difficult conversions and meet excessive demands in unfamiliar fields. All excess producing and load carrying capacity must be put into service but safety factors must not be reduced more than is absolutely necessary. The insulated wires and cables in service must carry increased load and with much less reserve to meet unpredictable peaks. New cables to take care of the added load are out of the question unless they are for vital war work in essential industries. Many raw materials are scarce and their use is restricted.

There are various ways to provide for more load on cables now in operation without making an unreasonable reduction in their factor of safety. They are more than ever worthy of consideration at a time when unlimited production is being asked for to meet military requirements. Some of them are suggested in a recent folder entitled "Cable Operation and Simplex Wires and Cables." If you are interested we shall be pleased to send a copy to you.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

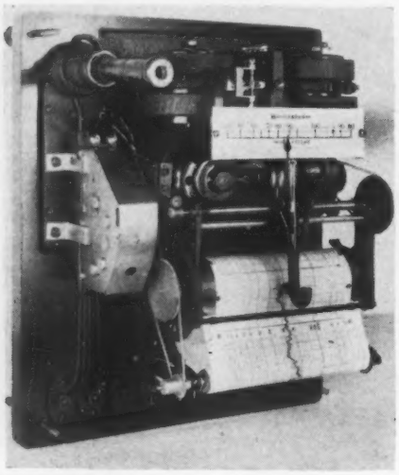
Simplex

WIRES and CABLES

P. F. Recorders Have Synchronous Clocks

By PAUL MacGAHAN
Meter Division, Westinghouse Electric & Manufacturing Company, Newark, N. J.

Relay type recording instruments for power-factor measurements are now equipped with a slow-speed remanence-type synchronous motor clock as used in the Westinghouse demand meters and time switches. In addition a new reroll-drive mechanism facilities the collection of the recorded chart, by practically eliminating bearing friction.



POWER-FACTOR RECORDER of the relay type equipped with remanence-type synchronous motor clock

The recorder illustrated is a true polyphase power-factor meter, which measures the power factor correctly, whether the load is balanced or not. These power-factor meters have coil windings similar to those in corresponding polyphase wattmeters, with the addition of a small phase shifter in the voltage circuit. This phase shifter, shown near the center of the instrument, is similar in appearance to the usual control motor which is at the right of the meter and which drives the pen across the chart.

However, the action of the meter is different from that of the well-known relay type recording wattmeter. In the wattmeter the position of the pen is geared to wind or unwind a control spring which balances the electric torque of the coils, thus opening the control motor contacts and stopping the pen at the kilowatt value for which the instrument is calibrated.

In this power-factor meter there is no control spring, but the miniature phase shifter is geared to the position of the pen mechanism by means of the worm and worm wheel shown at the left of the pen-driving worm. The action of the phase shifter is to alter the phase relation of the voltage coil circuit until the voltage coils are at quadrature with the current coils, causing the wattmeter element torque to become zero. This opens the control motor contacts and the pen rests at a position which corresponds to the position of the rotor of the phase shifter.

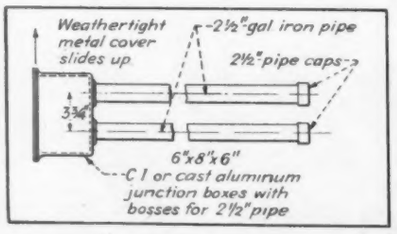
The angle through which the phase shifter must be turned to obtain this zero condition is the same as the vectorial mean angle of lag or lead, of a balanced or unbalanced three-phase circuit. At unity power factor this angle is 90 deg., thus producing a condition of zero power factor in the wattmetric coils. For other power factors the angle is greater or less.

Operation of the control motor and contacts keeps the power factor on the wattmeter coils zero and, as the pen is geared to the phase shifter, it records the vectorial mean angle of the lag or lead. The cosine of this angle is the vectorial power factor as defined by the A.I.E.E. The scale and chart are marked in terms of power factor.

•

Adapt Junction Box To House Switch-stick

The ever-present problem of how to keep switch-sticks out of the weather in unattended substation and switching structures has been solved by Commonwealth & Southern Corporation, Jackson, Mich., by using a conventional junction box. Conventional cast-iron or cast-aluminum boxes with a sliding weathertight metal cover are used, specified with one or more bosses at the back to take 2½-in. pipe. With a suitable length of pipe attached to the junction box and closed at the far end with a pipe cap, the arrangement provides an admirably watertight compartment. Care is used to mount the housing at a slight pitch so that condensation in the pipe will drain forward into the junction box and out. A 2½-in. pipe is used so that "hot-line" tool heads can be placed on end opposite hook and one stick used for two purposes.


Weathertight metal cover slides up
2½" gal iron pipe
2½" pipe caps
3¾"
6"x8"x6"
C I or cast aluminum junction boxes with bosses for 2½" pipe

INCLOSURE for combination switch- and hot-line stick

•

More Steam—How?

14. Minimize Air Leakage*

By ALFRED IDDLES
Application Engineer
The Babcock & Wilcox Company

Most people are still specifying steel casings. Some tell me that they do so because of the appearance and others because they expect the casing to be tight and therefore the air leakage into the unit will be very low. The matter of appearance, I suppose, is a matter of artistic temperament and perhaps of prejudice, and I am willing to defer to any one's wish who has the power to choose. With those, however, who assume that a steel casing will prevent air leakage I must disagree.

I know of plenty of well-cased jobs, with all of the casing seams welded, which in nowise have low air leakage. I saw one recently where the casing was perfect except that it was open at the bottom and the air seeped in between the insulation and the setting or up through cracks in the insulation, so that the result was anything but proper. To really put a casing around the entire unit and make the casing itself air-tight is exceedingly difficult. There are many openings, places where tubes come in or out, soot blowers and other points, where leakage can occur unless very expensive seals are made. It can be done. I know of one unit where there is 1 point difference in excess air between the burners and the economizer outlet. I know of another unit where the same general type of casing was used and where there are at least 20 points difference between these two extremes.

Steel casings are sometimes used for a third purpose; that is, to act as an external armor coat against possible injury to operating person-

* This series began in the May 16, 1942, issue of "Electrical World," adapted from author's talk "What the Operator Wants to Know" to Steam Power Division, A.S.M.E., Metropolitan Section, March 25, 1942.

Call Scully for

NATIONAL EMERGENCY ALLOY STEELS

TO save critical materials such as nickel and chromium, "National Emergency Alloy Steels" have been developed as substitutes for the old style alloy steels. These new alloy steels cover a wide range of properties and were especially designed to meet present conditions. Many of them are actually out-performing the steels previously used.

Our stock of these "National Emergency Alloy Steels" is now coming in. We welcome your inquiries and orders and would be happy to assist you in determining the grades best suited to your needs.

Telephone, wire or write the Scully Warehouse nearest you—see phone and teletype numbers above.

Do you lack steel to complete a rush war job? Is your production in danger of being slowed down or stopped for want of some piece of steel or steel product? Then call the nearest Scully warehouse. Many such calls have kept wheels turning. If we don't have what you need, you can be sure that we'll do everything possible to help you get it.

Our first job, like yours, is to speed war production. Every one of our warehouses is on the job day and night. And although our stocks of steel are not what we wish they were, what we have can be yours in a hurry—subject, of course, to priority restrictions. So try Scully—note our phone and teletype numbers above.

Scully Service

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SCULLY STEEL PRODUCTS COMPANY

Distributors of Steel and Steel Products

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UNITED STATES STEEL

nel in case of failure of pressure parts. Usually such failures result in dislocation of tubes and severe commotion inside of the furnace or boiler setting and seldom appear on the outside, although there are a few cases in which the wall construction, including buckstays and support for insulation, was of such a nature that tube failure resulted in force applied on the outside and, in the absence of casing, might have caused a dangerous condition to personnel had they been adjacent at the time of the failure. If a casing is to be omitted, as is frequently done nowadays, care should be taken to provide details of construction to minimize the risk from a safety standpoint.

I have observed that the most important feature is to have the insulation put on the outside of the pressure parts and brickwork, where such exists, in such a way that there can be no leaking through, either horizontally or vertically and then horizontally. This may mean at least breaking joints and well buttering them. It usually means applying the insulation with horizontal barriers to prevent leaks and applying a sealing coat on the outside of the insulation to prevent infiltration from the outside, and then to hold all of this insulation tightly in place either by pressure from the casing or by tie bolts back to the pressure parts, with reinforcing attached to these bolts and arranged to apply the pressure.

Usual construction today should produce a leakage of not more than 10 points in excess air and more likely 5 or 6 between the burners and the economizer outlet. More than this is not desirable because really the air should be put in at the burner and incidentally heated up through the air heater, and if the excess air is much about 20 or 25 percent the dry gas loss becomes a worth-while item.

The manner in which units are supported and the location of the necessary expansion joints have a material effect upon air leakage. In general, where the casing and the unit can come and go together and as a whole, there is less chance of leakage than in the older units where part of the unit is bottom supported and part top. If the unit is small enough, of course it can be bottom supported. If not, then probably the minimum of troubles occur when it is top supported.

I conclude on this point that several different types of units are available with inclosures which can be made tight enough so that the leakage need be no more than 5 or 6 or 7 points in excess air.

•

Pole Yard Adapted to Pentachlorphenol

Following a series of tests which proved the practicability of treating the above-ground portions of Western red cedar poles with a 5 percent solution of pentachlorphenol in place of creosote, Southern California Edison Company, Ltd., adapted its Alhambra pole-treating yard for a nonpressure preservative treatment with the pentachlorphenol solution. Since May this treatment has been applied exclusively in the full-length treating tanks in the yard.

Principal problem in the conversion was preparation of the 5 percent solution. At the time the Alhambra

PLACING combined dam and wire mesh basket in a 63-ft. treating tank preparatory to mixing pentachlorphenol solution

treating plant was built care was used in the design of the treating tanks. Pipe connections were made near each end of the full length tanks and provisions were included for installing removable steel dams so that the tanks could be divided for treating short poles. By installing one valve in the piping and placing a combination dam and mixing basket near the center of one of the treating tanks, it was possible to circulate the solvent from one half of the tank, over the dam into the other half and at the same time heat it from the steam coils in the treating tank.

A wire mesh mixing basket was constructed on the lower side of one of the steel dams so that hot oil would fall over the top of the dam into the basket. Heavy wire screen was used to support a 20-mesh inner screen which would hold the pentachlorphenol until it was dissolved. Pentachlorphenol was emptied directly from shipping containers into the basket and quickly dissolved in the 200 deg. F. heated solution. Two men working two eight-hour days were able to prepare 40,000 gal. of 5 percent solution as rapidly as the pentachlorphenol could be emptied from its 100-lb. containers.

PENTACHLORPHENOL CRYSTALS are poured into this basket for mixing in the hot solvent-carrier oil. The respirator worn by the workman protects his lungs against pentachlorphenol dust

The solvent-carrier used is an oil known as "Edeleanu" extract from sulphur dioxide refining of transformer oil obtained from local refineries. It will hold well in excess of 5 percent by weight of pentachlorphenol in solution at 32 deg. F. and its flash point of about 270 deg. F. permits its safe utilization in open treating tanks at a temperature above the boiling point of water. Furthermore it dries by oxidation in a manner similar to the linseed oil in paint, but more slowly. Even though freshly treated poles may be oily on the surface, they will become dry in a few weeks of exposure to the atmosphere.

JUNK YOUR METAL GUY-GUARD CRIPPLES

WPB says "no more metal guy guards" —so now is the time to standardize on "Flexibal"—the all wood guy guard that has already made the metal guard obsolete for some of the largest utilities.

REPLACE THEM WITH

Flexibal
THE WOOD GUARD FOR GUY WIRES

The Sensible Guy Guard that *Really* does its job

Guy wires are dangerous — a constant source of liability. That's why you use guy guards. There are just two basic jobs that a guy guard must do — (1) it must be the "spot-light" that gives visibility to the guy, warning people and livestock of its presence; — (2) it must neutralize the danger against impact, a shock-absorbing buffer that wards off danger. "Flexibal" is the *only* guy wire protector that adequately meets these requirements. It is the *only* guard that can be forgotten once it is installed — no more bent or crippled guards that stick out menacingly until replaced. "Flexibal" is fool-proof. It's been field-tested for years in thousands of locations. 5- 6- 7- 8-ft. lengths in stock for immediate shipment — at a cost that makes it cheaper than anything else on the market.

SUPPLIED DIRECT OR THROUGH JOBBER

S. E. OVERTON COMPANY
SOUTH HAVEN, MICHIGAN

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Issues Home Guide to Appliance Repair

"The electrical appliances you bought last year and in the years before are now more valuable than ever. For many of them cannot be replaced today. Many will have to last for the duration."

Thus reads the introduction of a booklet that Indiana Service Corporation has prepared and distributed to its customers giving suggestion on the home repair of electrical appliances.

Approach to the subject is definitely first-aid or what-to-do-till-the-doctor-comes in nature. For the 14 more commonly used appliances, the book outlines the diagnosis and home treatment of common minor ills that usually puzzle the housewife. Radios, mixers, heating pads, electric razors, etc., have not been included in the handbook as it was felt that they should receive the attentions of a skilled repairman who can provide service and needed parts.

HOW TO USE THIS BOOK
¶ First, turn to the Index on page 2 and select the appliance that needs servicing.
¶ Second, refer to the page number listed and you will find the most frequent causes why your electric appliance fails to operate.
¶ Electric appliances can only give the best service if kept in proper repair.
¶ Many simple repairs can be made at home, but if in doubt call or take your appliance to your dealer or a competent service shop.
¶ To help get full satisfaction from your electric appliances and make sure they will last, you should periodically inspect your equipment, using this book as a quick-check service guide.
CARE OF APPLIANCES
The Electric Appliances you bought last year — and in the years before are now, more valuable than ever. For many of them can't be replaced today. Many will have to last for "the duration"
To "Keep 'Em Working" the Indiana Service Corporation has prepared this booklet for its customers, which contains many helpful suggestions for making minor repairs to your electric appliances.
For most satisfactory results, appliances should be used in accordance with the manufacturers' instruction book, and if lost, an extra copy can usually be secured from your dealer.
INDIANA Service CORPORATION
122 East Wayne St. • Fort Wayne, Indiana

FIRST-AID GUIDE to home appliance ills issued by Indiana utility

Typical of the type of advice given housewives in the booklet is that pertaining to roasters and covering the three contingencies: (1) When the roaster does not heat; (2) does not heat enough, or (3) gets too hot.

Roaster does not heat:

1. Thermostat set at "off" position. Reset.
2. Check appliance service cord, wall plug connections and fuses.
3. Roaster element burned out.
4. Thermostat stuck open.
5. Loose connections inside roaster or thermostat.

(Items 3-4-5 refer to your dealer for servicing.)

Roaster does not heat enough:

1. Thermostat set too low. Use higher settings.

Roaster gets too hot:

1. Thermostat set too high. Use lower setting.
2. Element shorted.
3. Thermostat stuck closed.

(Items 2-3 refer to your dealer for servicing.)

For reference in cases of doubt or where the treatment is beyond the capacity of the appliance first aider the booklet lists 24 Fort Wayne electrical appliance dealers and repair shops that can be called in for service and parts.

In making up the list, individual calls were made on 50 Fort Wayne dealers. They were asked: (1) If they were interested in doing repair work. (2) What appliance they were best qualified to repair. (3) If they were interested in having work referred to them. As noted, 24 were interested in doing repair work and having work referred to them. Of these 24 repair-minded dealers eleven offered complete appliance repair service, four repaired all appliances and also radios, one repaired radios and small appliances, three refrigerators alone, while the remaining five specialized in the repair of one or more special appliances.

The specialized service that each dealer is prepared to render is listed in the repair handbook together with the dealer's name, address and phone.

•

Refrigerator Exchange Plan Proves Its Worth

In a thirty-day period 76 customers of the Georgia Power Company bought used electric refrigerators from other customers. This resulted from an exchange plan conceived and promoted by the company during the past summer.* In the reported period 401 customers registered as wanting to buy and 154 as wanting to sell. About half of the refrigerators listed were sold.

It was to have been expected that many more wishful buyers than willing sellers would be brought to light. As shown by the foregoing figures, this was the case in total. But in one division of the company, the largest, that in which the city of Atlanta is contained, the condition was the exact opposite. More sellers — 80 — than buyers — 71 — were listed. Sales in Atlanta numbered 43, more than half of the offerings.

The plan is operated very simply. In each division office are listed the

*"Brings Buyers and Sellers Together," page 112, "Electrical World," September 19, 1942.

HOW AN ALL-GIRL ORCHESTRA IS HELPING TO WIN THE WAR!

THESE ARE THE GIRLS you hear every Sunday evening over 125 NBC stations on the General Electric "Hour of Charm." Here's how they are doing their part in the war effort:

1. *During the past year they have given scores of performances in every branch of the nation's armed services, in camps, training stations . . . even on a battleship.*

2. *Their success has built up a listening audience in 5,000,000 homes a month — one out of every five wired homes in the United States!*

3. *In the past 51 weeks since Pearl Harbor there have been 100 messages on wartime lighting. Multiply these by the number of people who are now hearing these messages and you get some idea of the tremendous influence exerted by this program!*

DID YOU HEAR THIS RECENT MESSAGE BROADCAST OVER THE "HOUR OF CHARM"?

ANNOUNCER (Richard Stark). The other day I was talking with a lighting engineer who spends most of his time working with war plants. Let's hear what he had to say.

VOICE. One thing that is worrying the owners of many factories is the problem of *night* production.

Theoretically the worker on a night shift should turn out as much work as a daytime worker. But too often he doesn't. In fact, I have talked with factory owners who just took it for *granted* that night workers would produce ten to thirty per cent less than daytime crews. Yet I have been in other plants where the "darkness shift" was running neck and neck with the rest. What made the difference? In most cases, just one thing. *Lighting.* Too many plants still have the same lighting they used before the war. Good enough to supplement daylight, but not at all adequate for the hours of darkness. Poor lighting does more than slow down the speed of the night worker. It *tires him out*—increases his chances of mistakes and accidents.

G-E MAZDA LAMPS
MADE TO STAY BRIGHTER LONGER

GENERAL ELECTRIC

FIRE and how to fight it!

HOW DO YOU KILL FLAMMABLE LIQUID BLAZES?

Q. What are flammable liquid fires?

A. They are fires in oils, gasoline, solvents, paints, lacquers, and the like. Authorities call these Class "B" blazes and recommend extinguishers with a *smothering* or *blanketing* action.

Q. Will every type of extinguisher work on all kinds of flammable liquid fires?

A. No! Water streams, for example, are usually ineffective and extinguishers which employ a liquid stream will generally not handle three-dimensional blazes.

Q. What is a three-dimensional fire?

A. It is a fire which burns at more than one level, as when an oil-filled transformer catches fire and spills a flowing stream of burning liquid down its sides. Carbon dioxide extinguishers readily handle this type of fire. Work from the bottom up, when fighting such a blaze. Kill fire at the bottom level first.

Q. What is a running fire?

A. It is a flammable liquid blaze which occurs when a flowing stream becomes ignited. You fight this fire by working against the flow of the liquid. If a pipe is leaking, start at the extreme edge of the fire and work back toward the pipe. If a container is spilling its burning contents, work toward the container.

Q. What is a spill fire?

A. This is simply a fire resulting from liquid spilled on the ground or on the floor. Don't try to kill all of this fire at once, if it covers a large area. Start at one point, smother all flames there and continue, part by part, until the entire fire is out.

If you are outdoors, *keep wind at your back.*

MAKE EXTINGUISHERS LAST LONGER

Since December 1941 Walter Kidde and Company has had an unusual war job . . . to make products that *save* fighting men's lives. These products include high pressure containers for aviation use, special type built-in extinguishing systems, crash trucks, and various flotation equipment.

Since we have fewer Kidde extinguishers* to sell, we are trying to make your existing fire fighting units more effective.

If you want reprints of this series of advertisements, just write to

Walter Kidde and Company, Inc., 1128 West Street, Bloomfield, New Jersey.

Kidde

*formerly known as "LUX" extinguishers

names of customers in that area who have refrigerators they want to sell. The list shows the make, age and asking price of each refrigerator offered. A prospective buyer looks over the list, finds an offer that appears interesting and then goes to the seller's home to see the unit. The company has no further concern in the matter. If a sale results the transaction is entirely between seller and buyer.

•

Free Bulbs for Appliances Repaired

Pacific Gas & Electric Co. has made an offer of free bulbs to customers having appliances repaired or turned in for scrap up to November 30, 1942. With each domestic service bill mailed or delivered in October the company sent a free lamp bulb certificate, entitling the bearer, under conditions, to obtain a 100-watt or a 150-watt lamp without charge. To obtain a lamp the customer had to have an electric appliance that was inoperative or in poor condition repaired by a dealer located in the company's electric territory, or else to turn in a worn-out appliance to such a dealer as a contribution to the National Stock Pile of Scrap Metals.

In turning in the appliance the customer is required to sign the certificate and leave it with the dealer, who, by arrangement with the P.G.&E., delivers the customer his choice of a lamp bulb. Only one lamp per customer is allowed under this arrangement.

•

To Save Window Lighting Business

In order to prevent loss of store window lighting business resulting from blackout preparedness as much as possible the Durham (North Carolina) Public Service Company put control of this lighting into the hands of the police department. Now a Durham merchant who has had his place of business properly equipped need not turn off his window lights when he closes his store.

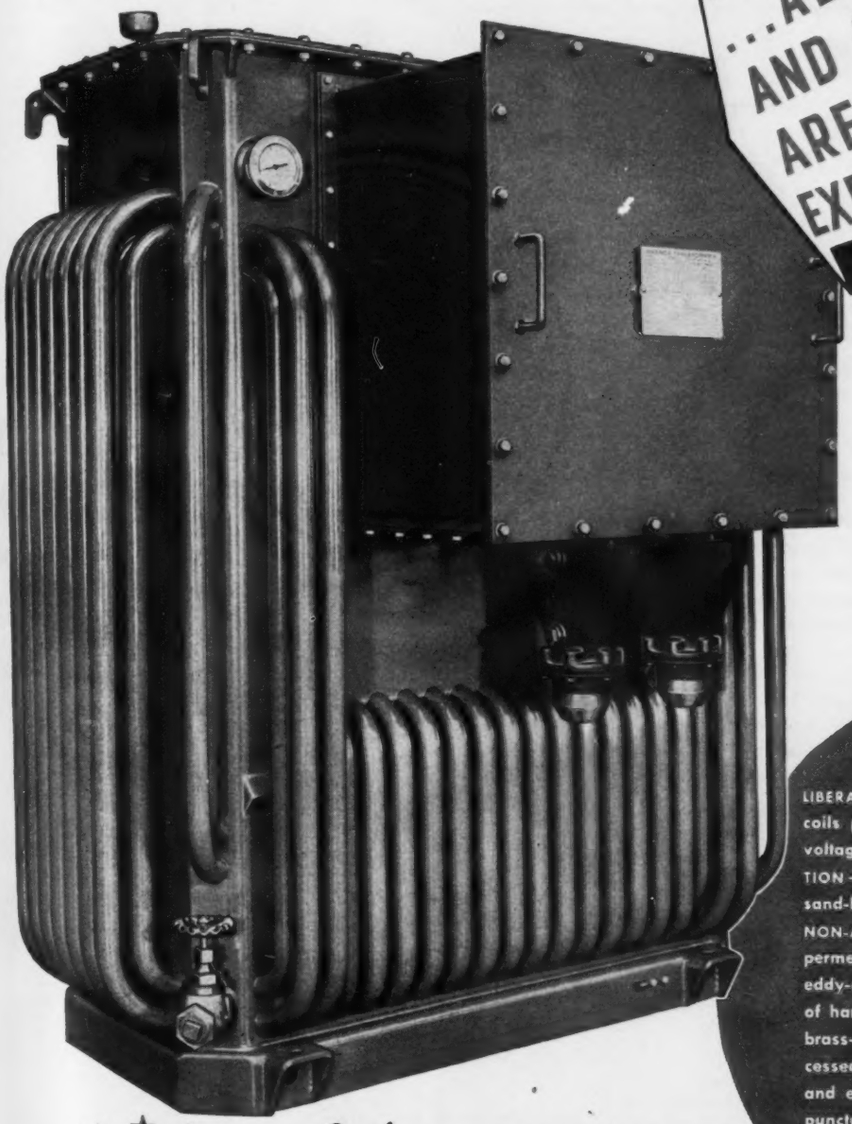
In the business district of the city there is an ornamental street lighting system with an overhead circuit in cable supported by messenger fastened up near the tops of the lighting unit poles. The messenger is

WAGNER POWER TRANSFORMERS

Provide a *Safety Factor* TO CONSIDER IN ALL INDUSTRIAL INSTALLATIONS—

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

...ALL BUSHINGS AND CONNECTORS ARE SEALED—NO EXPOSED LIVE PARTS



Wagner transformers can be furnished with junction boxes, "tailored" to meet any installation requirement.

These junction boxes eliminate the expense of purchasing and installing separate devices, save valuable room and installation time, and add the SAFETY of entirely metal-clad apparatus with no exposed live parts to cause damage or injury.

Features

LIBERAL INSULATION—extra end-turn insulation on coils provide protection against line surges and voltage disturbance . . . HEAVY TANK CONSTRUCTION—heavy steel plate, electrically welded, sand-blasted and flow-painted . . . CORE IRON OF NON-AGING SILICON STEEL—has high magnetic permeability and has very low hysteresis and eddy-current losses . . . STATIONARY CONTACTS—of hard-drawn copper, sweated and pinned into brass-shouldered studs . . . BUSHINGS—wet-processed, solid porcelain with sufficient mechanical and electrical strength to carry the load without puncturing . . . TRANSFORMER OIL—has high dielectric strength, proper viscosity, safe flash-point, and will not sludge.

Send **FOR BULLETINS TU-180 and TU-181 illustrating and describing the complete line of Wagner Transformers.**

T42-12

BUY WAR BONDS

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

Now—102 engineers and scientists help make the new

STANDARD HANDBOOK for ELECTRICAL ENGINEERS

dependable and practical for you

NEVER BEFORE SO MUCH PRACTICAL, UP-TO-THE-MINUTE HELP FOR ELECTRICAL ENGINEERS IN A SINGLE VOLUME

ARCHER E. KNOWLTON, *Editor-in-Chief*
Associate Editor for Engineering, Electrical World

7th Edition, 2303 pages 6x9, 1700 illustrations, 600 tables, $8.00

What the Standard gives you

—definitions, conversion factors, physical and mathematical principles.
—accepted formulas and experimental data
—bases of design of electrical equipment for commercial performance
—principles and practice of assembling such apparatus into systems.
—criteria and results in applying electricity in various industries, etc.
—the information you want in the form in which you can use it; the means of avoiding errors, saving time and trouble in procuring vital information, assuring yourself of best results in handling a wide variety of problems.

Here is the great standard reference work of all in the electrical engineering profession or whose work in industry or engineering touches on this field. Its 2303 pages present a handy-reference compilation of practical, usable data from all fields of electrical engineering practice, plus the most frequently required fundamental theory, units, and systems of measurement, made dependable by the work of more than 100 engineers, scientists, teachers, and other authorities.

Thousands of useful facts in these
26 BIG SECTIONS

Units and Conversion Factors
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Measurements
Properties of Materials
Circuit Elements
Transformers, Regulators and Reactors
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Direct-current Generators and Motors
Rectifiers and Converters
Prime Movers
Power Plant Economics
Power System Electrical Equipment
Power Transmission
Power Distribution
Wiring Design—Commercial and Industrial Buildings
Illumination
Industrial Power Applications
Electric Heating and Welding
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Batteries
Wire Telephony and Telegraphy
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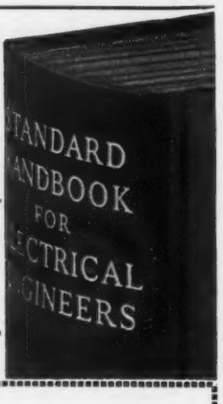
DESIGNED TO USERS' SPECIFICATIONS

Before setting the pattern for the new edition, the Editor-in-Chief interviewed a large number of users of previous editions, to see what they would like the new edition to be. As a result of their suggestions, the Seventh Edition contains such basic improvements as more emphasis on handy-reference compilation of usable facts, less historical material and more data about equipment, materials, and practices, more sources of industry standards, codes and specifications, and expanded index, as well as complete revision of subject matter to keep abreast of current practice.

NEW SEVENTH EDITION

- every section fully revised
- whole new sections; actually hundreds of pages of new material
- more contributors; every section treated by an expert
- new format; larger page, larger type, larger diagrams



Benefit as thousands have

Tens of thousands of engineers have benefited from former editions of the Standard. With this up-to-date edition you will too. On hand when you need it, the book gives security in troublesome situations, saves dollars, hours, and effort by giving the right, dependable answer at the right time. Take this easy step that may mean much to you later. Mail the coupon today.

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Send me a new 7th edition Standard Handbook for Electrical Engineers for 10 days' examination on approval. Within 10 days of receipt, I will send you $8.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

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fixed to the pole by a straight three-bolt clamp. One bolt of the clamp was replaced with the pin for an insulator. On these insulators was run a pilot wire circuit using the messenger as a grounded return. Drops from this circuit run into stores equipped to receive it with relays and contactors in the window lighting circuits.

Control of the pilot circuit is installed at police headquarters. Now when the air raid alarm signal is received the store window lighting is turned off by the officer or warden in charge and is out for the blackout period only. At all other times the lighting operates in the normal way according to time switch settings.

•

Permits Good Window Lighting in Dimout

Advertisement of Consolidated Edison promoting the return of good show window lighting to New York after authorities approved screening of windows to prevent outside spill of light.

Survey Use of Bikes by Utility Companies

Extent to which bicycles are being used to replace cars and other forms of transportation by a group of 18 member companies of the Public Utility section of the National Safety Council is given in the accompanying table. This tabulation was taken from a paper, "Bicycling with Safety," by A. J. Naquin, New Orleans Public Service Company, presented at the National Safety Congress, October 27, 28 and 29, in Chicago.

Of the 50 member companies of the Public Utility section 31 replied to the questionnaire and 18 reported use of one or more bicycles. Practically all of these companies use bicycles for meter reading. Some two-thirds of them provided bicycles for service men and about 50 percent purchased them for collectors. Other small groups used bicycles for meter inspectors, investigators, surveyors, mail and messenger boys and general utility purposes.

Maximum number of bicycles owned by any one company was 99. The average number owned per company was 28. The average number in use was 21. No significant number of companies reported use of motorbikes or motor cycles.

Only two companies reported accidents during 1942 resulting from the use of bicycles. None of the 18 companies are conducting special bicycle safety programs, although six companies are instructing employees in the safe use of bicycles.

Use of Bicycles by Utilities

Name	Number in Use	Used By
1. Amarillo Gas	1–10	(a), (c)
2. Arkansas P. & L.‡	66	(e), (d)
3. Atlantic Gas Light	50–100	(a), (c), (d)
4. Brockton Edison	1	(f)
5. Central Maine Power	1–10	(a), (c)
6. Central Ohio L. & P.	2	(a), (c), (f)
7. Central Vermont P. S. Co.	16	(a), (c)
8. Coast County G. & E. Co.	24	(a), (c), (d)
9. Consolidated Gas, Electric Light & Power	2*	(d), (e)
10. Dallas Power & Light	10–15	(a), (d), (e)
11. Detroit Edison	7†	(a), (b)
12. Eastern Shore P. S.‡	39	(a), (c), (d)
13. Florida Power Corp	24	(a), (c), (d)
14. Indianapolis P. & L.	12	(a), (c), (e)
15. Iowa Elec. L. & P.	1–10	(a)
16. Louisiana P. & L. Co.	1	(f)
17. Long Island Lighting	50–100	(a), (e)
18. Jersey Central P. & L.	56	(a), (c), (d)

* Consolidated Gas, Electric Light & Power Company of Baltimore owns 10–50 bicycles.
† Detroit Edison Company owns 99 bicycles.
‡ These companies reported one accident each resulting from use of bicycles.
(a) Meter readers, (b) meter inspectors, (c) service men, (d) collectors, (e) investigation and general utility, (f) messengers, mail.

When the going gets tough!
Use these TOUGH FASTENINGS
DESERT heat, tropic sweat, arctic subcold, ocean salt—they're all alike to tough Harper Fastenings.
That's why these versatile workers have been drafted for service in tanks, ships, planes—wherever fighting equipment has to fight rust and corrosion, extra stress and strain.
WELL NAMED "EVERLASTING"
Harper Fastenings—bolts, nuts, screws, washers, rivets and special items—are made only of brass, bronze, copper, Everdur, Monel or stainless steel.
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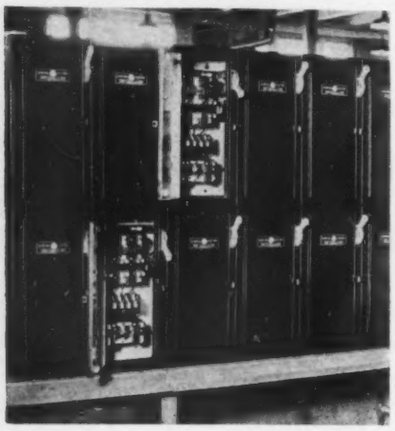
HARPER Chicago
EVERLASTING FASTENINGS

NEW EQUIPMENT

Magnetic Starters

Alternating-current combination magnetic starters for full-voltage starting of induction motors up to 7½ hp. consist of a



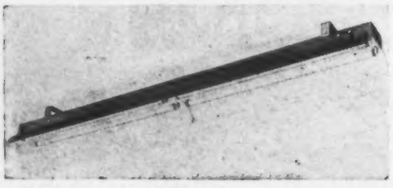
Combination magnetic starters; available only in N.E.M.A. sizes 0 and 1 as yet. **General Electric Co.**, Schenectady, N. Y.

fusible motor-circuit switch and a magnetic starter incorporated in one compact unit to conserve space, reduce installation time and provide greater protection for equipment and operators. Bimetallic overload relays are adjustable for either hand or automatic reset and protect the motors from overheating due to repeated overloads, sustained overloads or too-frequent starting. Cabinets are all-welded steel and flush-type doors close tightly. An interlock prevents opening the door until switch is off.

•

Fluorescent Fixtures

Eight new industrial fluorescent fixtures have composition reflectors finished in Mira-coat baked white enamel. Units consist of reflectors, lamps and Mirastat starters. Continuous-row models are equipped with Sylvania "Slide-Grip" hangers.



"Model HFF-208P," shown, has four 40-watt lamps, for continuous row installations. **Sylvania Electric Products, Inc.**, Fluorescent Fixture Division, Ipswich, Mass.

•

Welding Electrode

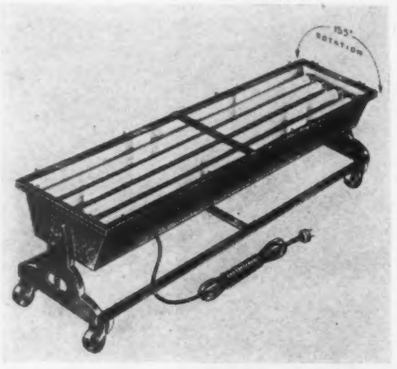
"Airco No. 230" electrode; made in ⅛-in. and 5/32-in. diameters. **Air Reduction Sales Co.**, 60 E. 42d Street, New York.

Designed for all-position welding of mild steel with a.c. type welding machines, new electrode complies with requirements of the American Welding Society Classification E6011. Device is said to provide good fusion and complete penetration.

•

Portable Luminaires

Designed for localized lighting in areas that cannot be properly lighted by overhead fixtures, new line of portable luminaires introduce portable fixtures to wheel or hang. Removable lamp shield protects user from glare.

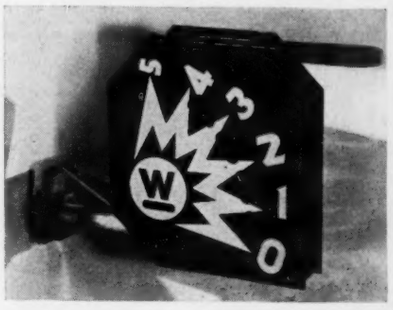


40-watt "Crawler;" portable fixture, shown, accommodates two and four lamps and is equipped with sockets, starters, high power-factor ballasts, toggle switch and 20-ft. cord and plug. For 110 or 220-volt, 60-cycle a.c. Also "Pickup" and "Skidway" models. **Day-Brite Lighting, Inc.**, St. Louis, Mo.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Operation Counter

Counter device consists of six thin copper strips, arranged in a small square counter box, mounted on the vent pipe from the



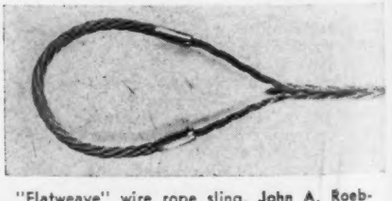
Operation counter for protector tubes on 13.8-kv. to 138-kv. transmission lines. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

protector tube. When the protector tube operates, part of the gas blast leaves through the small side horizontal tube on which the counter is mounted, blows off a copper blade, and the box falls into another angular position. The new position indicates the number of operations. Device is equipped with loop-shaped strap for installing and removing it with a hook stick, and blades are available for reloading.

•

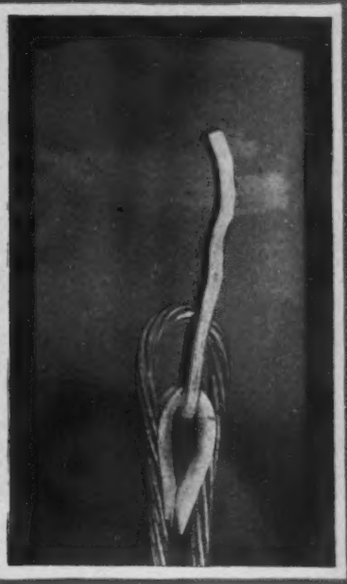
Sling

Wire rope sling consists of six separate ropes and is useful for lifting light and medium loads where the legs choke the load or the sling comes in direct contact with the load. Sling has a flat bearing surface which allows an even pressure on each of the six ropes, thus prolonging its life. Flat and flexible, it may be passed through or under the load. There are no splices, tucks or servings to become dislodged or loosened over sharp corners or in pulling underneath loads.



"Flatweave" wire rope sling. **John A. Roebling's Sons Co.**, Trenton, N. J.

The Phantom Lineman

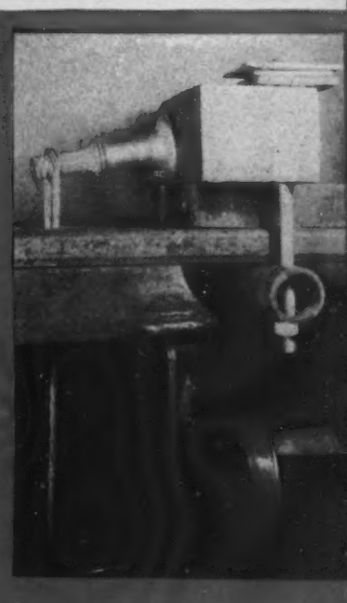


Wherever your power or communication system may serve; whatever its hazards may be and whether your crew is made up of one or hundreds of workers, the Phantom Lineman is also there working for you. He is on the pole, hard at work while your men are eating lunch and he is there when they are off duty recuperating for the next day's labor.

He is revealed for the first time by the accompanying photos showing how only a few of many hundreds of tests are carried out to insure the highest possible quality in Hubbard Pole Line Hardware.

For the Phantom Lineman is none other than old man "Test", the fellow who puts his finger on the bugs in a product. He is the one who checks the stresses, strengthens the weak spots, trys the practicability of the item and then stands by while it is in service on your lines.

He notes with satisfaction that his work has enabled your service to hold up through a severe winter storm, spring sleet or burning desert heat. He is the phantom who started his work in the Hubbard test laboratory and continues, shoulder to shoulder with your linemen.



"HANG THE LOAD ON HUBBARD HARDWARE"

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

ONLY A COMPARATIVE FEW
of us will feel the exultation of seeing an enemy raider through a periscope, watching it disappear as an American torpedo goes home

Millions of us must be content with doing the unspectacular. Millions of us must remember that for every stick of bombs released, for every torpedo a U.S. ship drives into its target, literally hundreds of our humble, unspectacular jobs had to be done...and done right...and done on time. Millions of us must remember, every minute of every hour of every day, that there is no unimportant job...that we will win this war at our desks, at our machines, with our picks and shovels...by doing our own jobs better than ever before!

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY • Branches and Warehouses in Principal Cities

ROEBLING
THE PACEMAKER IN WIRE PRODUCTS

TECHNICAL LITERATURE

APPARATUS BUSHINGS—A.I.E.E. standards apply to outdoor type bushings for larger apparatus, cover types for small apparatus and indoor type for apparatus except dry type instrument transformers, air-blast transformers, dry type regulators, and circuit breakers rated below 5,000 volts, and non-oiltight oil circuit breakers rated 50,000 kva. or less. "Standards for Apparatus Bushings and Test Codes for Apparatus Bushings" is Standards No. 21 and can be obtained from the American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.; price 40 cents.

SPLICING SLEEVES—"Specifications for Single-Tube Seamless Copper Splicing Sleeves" is issued as engineering information on oval and grooved-oval types of sleeves commonly used in overhead line construction; supersedes NELA specifications D950-28T and D950-31T. Copies of the new specifications, publication No. TD-9, may be obtained from Edison Electric Institute, 420 Lexington Ave., New York, N. Y.; price 10 cents each.

SPECTRUM CHART—A detailed analysis of the electromagnetic spectrum, with emphasis placed on uses of each kind of radiation, is presented on a seven-color, 30x40-in. wall chart. The chart, price $2, may be ordered from Publications Section, 6-N-17, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

RECTIFIERS—Methods of providing multiphase operation of rectifiers in large capacity installations and results of field tests employing 24, 30, 36 and 60 phases are given in "Wave Shape of Multi-Phase Rectifiers." The Engineering Report No. 49 of a joint subcommittee of Edison Electric Institute and Bell Telephone System is obtainable, at appropriate prices, from E.E.I. headquarters, 420 Lexington Ave., New York, N. Y.

TRANSFORMER STANDARDS—A revised edition of "Transformer Standards" is Publication No. 42-73, superseding Publication 32-12, obtainable from National Electrical Manufacturers Association, 155 East 40th St., New York, N. Y.; price $3 per copy. Standards are included for power and distribution transformers and reactors, also information on lead markings, and connections for constant potential transformers, as well as definitions.

V-BELT DRIVES—A wealth of engineering information is reduced to simplified charts and tables for quick selection of V-belt power transmission equipment—covering Texrope belts, constant, adjustable and vari-pitch sheaves and vari-pitch speed changers. Bulletin B-6051-C may be obtained from Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

TACHOMETER—The "How" of operation, brief description of two models, and instructions for use of type DS chronometric tachometers (speed indicators) are contained in Bulletin 715, obtainable from Herman H. Sticht Co., 27 Park Place, New York, N. Y.

ALUMINUM—General principles of machining aluminum and its alloys, suggested speeds, feeds and depths of cut, use of practices and tools common to other metals, special practices and tools desirable are set forth in a booklet, "Machining Alcoa Aluminum," obtainable from Aluminum Co. of America, Pittsburgh, Pa.

LIGNOLITE A LAMINATED LIGNIN PLASTIC

FOR ELECTRICAL INSULATION

In addition to its Low Moisture Absorption LIGNOLITE has the following valuable properties—High Dielectric Strength which makes it an efficient insulation for many types of electrical equipment—Arc Resistance of 183-188 seconds,* superior to that of most laminated plastic insulating materials in general use today—High Strength—Weight Ratio. It has exceptionally good oil resistance and is easily machined and fabricated.

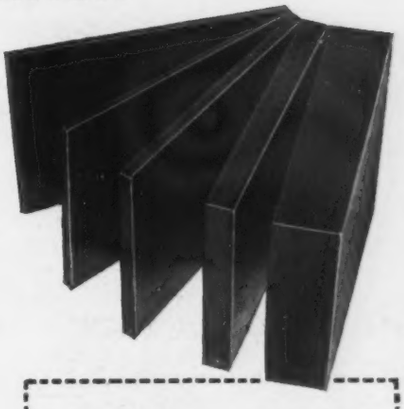
No critical materials enter into the manufacture of LIGNOLITE—it is, therefore, readily available for all applications.

Produced in black, satin, or molded sand blast finish—in 46-inch x 46-inch sheets, in thicknesses from 1/64 inch to ⅝ inch and 40-inch x 40-inch sheets in thicknesses over ⅝-inch to 2-inches. Other sizes can also be made available. Please write for details.

* Determined by tests made at Electrical Testing Laboratories according to ASTM Standard #D495-41.

SUGGESTED USES: Base plates for mounting electrical equipment — Terminals and Electrical Connections — Switchboards and Panel Boards—Barriers—Spool heads—Insulating Washers—Linings for metal-clad switchgear cabinets. Foundry Pattern Plates—Nameplates. Some manufacturers are using LIGNOLITE for constructing cabinets to house electrical equipment.

MARATHON CHEMICAL COMPANY
Div. of Marathon Paper Mills Co.
ROTHSCHILD WISCONSIN



SEND FOR BULLETIN

showing properties, characteristics and methods of fabricating and using LIGNOLITE.

Also ask for a Sample (FREE) for your personal inspection and test.

"12 YEARS SERVICE HAVE PROVED HOW RIGHT WE WERE..

..WHEN WE STANDARDIZED ON BUSS *Super Lag* FUSES"

"BACK IN 1930 in an effort to prevent production interruptions caused by fuses blowing needlessly we decided to standardize on BUSS Super-Lag fuses. We now stock sizes from 3 ampere to 400 ampere.

"12 years service have proved how right we were. We have found that the time-lag in these fuses is of material value in preventing fuses from blowing on starting loads or temporary overloads sometimes caused by machines being crowded too much or carelessly handled.

"The fuse design also seems to be unusually effective in preventing poor contact from burning up fuses as well as the clips in our switches and panelboards.

"We feel that BUSS fuses have definitely cut production losses we would otherwise have incurred."

Neil K. Bangs, Ch. Elecn.
The Fox Paper Co., Lockland, Ohio.

"We feel that BUSS fuses have definitely cut production losses we would otherwise have incurred."

Avoid shutdowns—save man-hours in your own plant.

The experience of Mr. Bangs simply proved once more that it is not necessary to suffer useless shutdowns caused by needless openings of

☆ ☆ ☆ ☆

BUSS SUPER LAG

protective devices. It shows that once properly installed, BUSS fuses can be forgotten.

They require no maintenance or periodic inspection—as do mechanically operated devices. They don't open needlessly. If one opens you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

Here is why BUSS fuses greatly reduce or entirely prevent needless blows.

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating which causes fuses to blow needlessly is prevented.

The fuse link used is the famous "BUSS Super-Lag". It has lag plates attached to it. These give it a long time-lag so that unusually heavy starting current or other harmless overloads will not cause the fuse to blow.

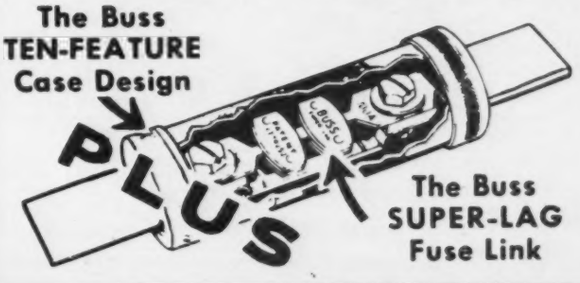
How to solve the "shutdown problem."

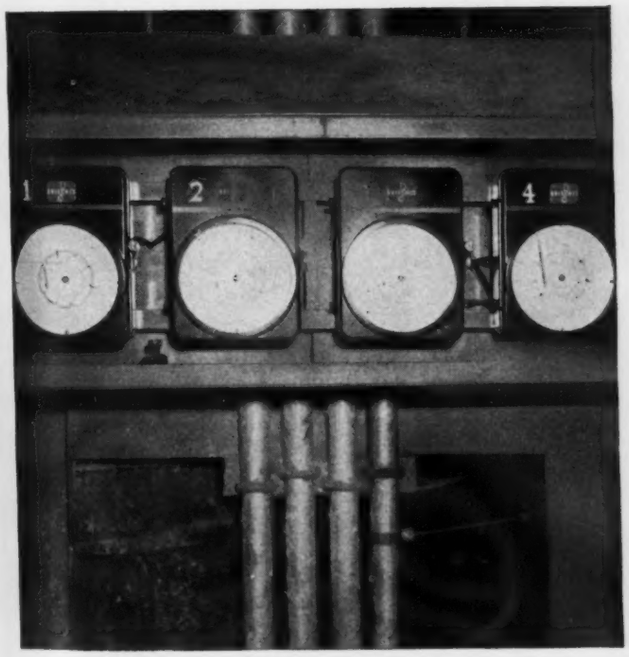
Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford.

Bussmann Mfg. Co., University at Jefferson
St. Louis, Missouri, Div. McGraw Electric Co.

WHY BUSS FUSES DON'T BLOW NEEDLESSLY

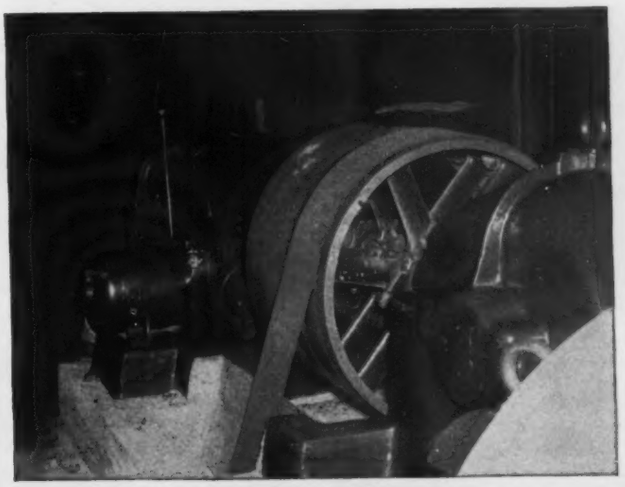
The Buss TEN-FEATURE Case Design

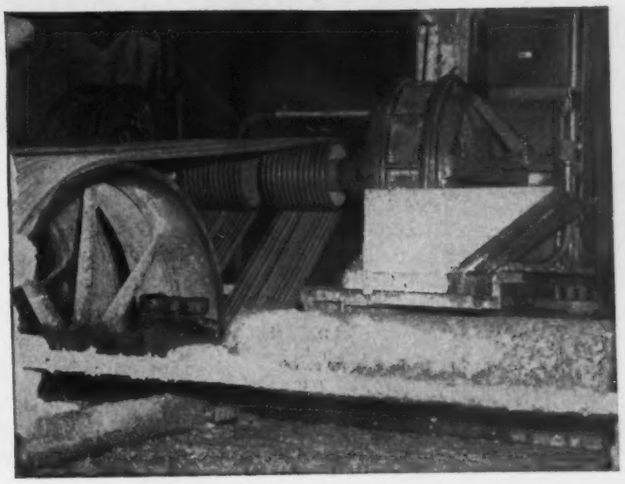




"We have found that the time-lag in these fuses is of material value in preventing fuses from blowing..."

FUSES





NEWS ABOUT PEOPLE

Skelton Heads Central Maine Power Co.

William B. Skelton of Lewiston, Me., has been elected president of the Central Maine Power Co., Augusta, succeeding the late Walter S. Wyman. Mr. Skelton, a vice-president of the company, has been closely associated for many years with Mr. Wyman and im-

portant diversified interests under the latter's aegis in the Pine Tree State. He was born in 1871 at Bowdoin, Me., and after being graduated from Bates College took up law and was admitted to the bar in 1893. He began practice at Lewiston. Among his many posts of responsibility have been presidency of the First National Bank, Lewiston, and Androscoggin & Kennebec Railway and of the Lewiston Gas Light Co.; treasurer Union Water Power Co. and Androscoggin Reservoir Co., Lewiston; director Boston & Maine R.R., Maine Central R.R., Androscoggin Mills, Bates Manufacturing Co., Hill Manufacturing Co., York Manufacturing Co., New England Industries, Inc., Maine Seaboard Paper Co., New England Public Service Co. Mr. Skelton is a former Mayor of Lewiston and former bank commissioner of Maine and from 1914 to 1919 was a member of the Maine Public Utilities Commission. He first became associated with the Central Maine Power Co. in 1922 when he was elected a vice-president. He became a director in 1924.

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▶ KINSEY M. ROBINSON, president of the Washington Water Power Co., Spokane, has been elected to the board of trustees of the Manufacturers' Association of Washington.

▶ A. F. HERWIG, executive secretary of the Wisconsin Utilities Association with headquarters in Milwaukee, has been named chief of emergency utilities of the Wisconsin Defense Council.

▶ C. B. HAYDEN will act as chief engineer of the Wisconsin Public Service Commission during the absence of GEORGE P. STEINMETZ, who has been called for active army duty.

▶ WILLARD BROWN, who has headed up general lighting activities for the lamp division of General Electric at Nela Park engineering department in recent years, has assumed his duties as Commander, Supply Corps, U. S. Naval Reserve; Washington, D. C. Mr. Brown is a past-president of the Illuminating Engineering Society. Appointed to act in his place at Nela Park is W. G. DARLEY.

▶ JOSEPH A. FRENCH, for 20 years an engineer with the Connecticut Light & Power Co., where he became research engineer of the eastern division with headquarters at Norwich, has joined the electrical engineering staff of Jackson & Moreland, Boston. Mr. French left the Connecticut utility in 1938 and was employed by Day & Zimmermann, Inc., Philadelphia; Guardian Manufacturing & Supply Co., New York and New Haven, and the Trimount Dredging Co., Norwich, before going to Jackson & Moreland's consulting offices.

R. L. Whitney Directs Transformer Sales

Russel L. Whitney has been appointed sales manager of the transformer division of the Westinghouse Electric & Manufacturing Co., Sharon, Pa., according to an announcement by H. V. Putman, vice-president and manager of the transformer division. A. C. Farmer, formerly assistant sales manager, has been named assistant to the vice-president, and A. P. Bender, formerly sales manager, has been made assistant sales manager to afford the best possible opportunity for his complete recovery from an extended illness.

For the past six years Mr. Whitney was sales manager of Westinghouse's porcelain department in Derry, Pa. He joined Westinghouse 22 years ago,

R. L. Whitney

shortly after he was graduated from the University of Colorado with a bachelor of science degree in electrical engineering. He was first assigned to the power sales department at East Pittsburgh, then went to the Philadelphia sales office and later to Allentown, where he became sales manager in 1931. His transfer to Derry followed in 1936.

A native of London, England, and a graduate of London University, Mr. Farmer joined Westinghouse in 1909 at the East Pittsburgh works and ten years later was named manager of the distribution transformer section of the supply department. In 1931 he was appointed manager of distribution apparatus sales at headquarters, and was named assistant sales manager at Sharon in 1932. He received the Westinghouse Silver "W" and Order of Merit in 1936 for "distinguished sales promotional capacity and energy."

Mr. Bender joined Westinghouse in 1906 following graduation from the University of Pittsburgh in electrical engineering. Since 1934 he has been transformer division sales manager.

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Iowa Group Elects New Panel of Officers

Co-incident with the transfer of the offices of the Iowa Utilities Association from Cedar Rapids to Des Moines, the board of directors has named a new panel of officers. They are: President, George Neal, president, Sioux City Gas & Electric Co.; first vice-president, B. F. Pickard, president, Interstate Power Co., Dubuque; second vice-president, C. A. Leland, president, Des Moines Electric Light Co.

W. R. Blake

William R. Blake, for 15 years associated with the Central States Power & Light Co. and the Interstate Power Co., has been named secretary-manager with offices in the Fleming Building, Des Moines. Mr. Blake is a former state representative from Fayette County, Iowa.

George Neal, newly-elected president of the Iowa Utilities Association, succeeds Sutherland Dows, president of the Iowa Electric Light & Power Co., Cedar Rapids, who has served as presi-

Battery of C-O-TWO Cylinders

Eternal vigilance is the price of uninterrupted production. Whether it's the indispensable electrical energy hurled out from giant generators of modern power plants or thousands of electric motors and appliances that depend upon electrical energy—all must be protected against fire and from damage due to the use of unsuitable fire extinguishing methods. C-O-TWO is proven, dependable fire protection.

DEPENDABLE *and* APPROVED

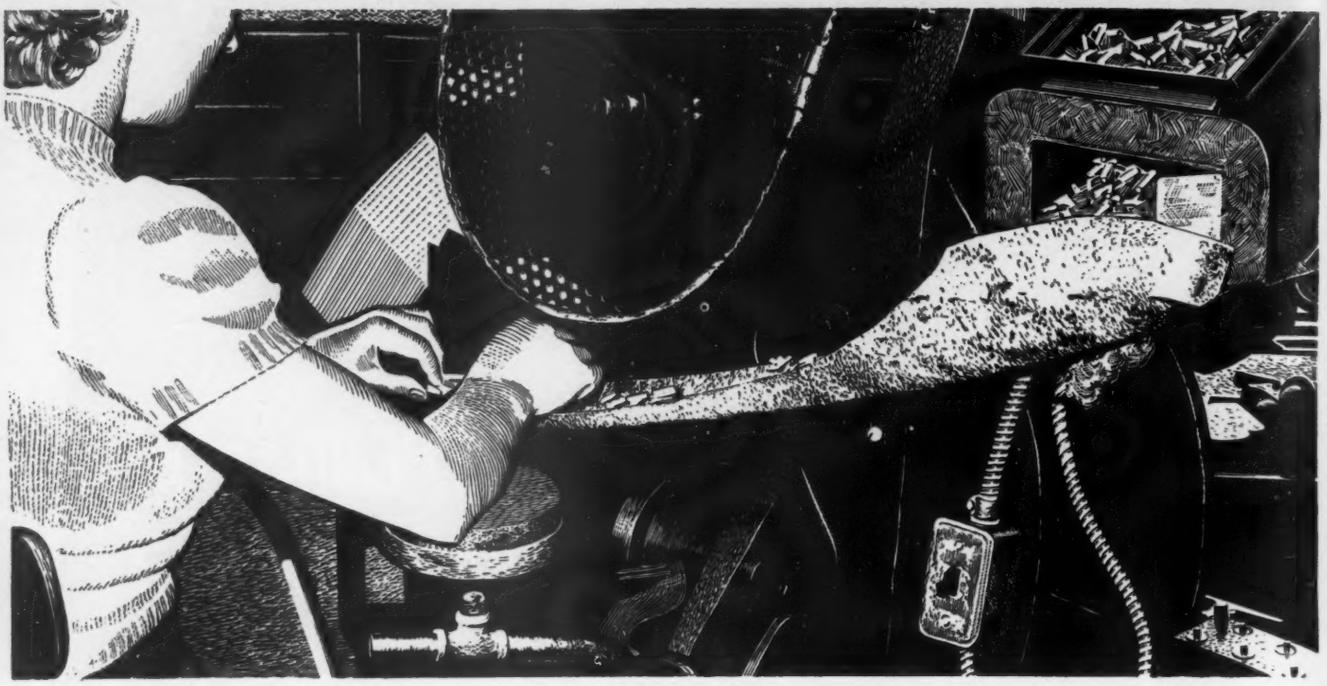
All C-O-TWO* equipment employs carbon dioxide, the fastest non-damaging fire extinguishing agent. At Grand Coulee, Boulder Dam, Bonneville Dam and other mighty power plants C-O-TWO automatic and manually operated fire extinguishing systems and C-O-TWO portables protect the turbines, transformers and oil storage vaults against fire. C-O-TWO hand and wheeled type portables or hose units are especially recommended for oil, grease, paint, lacquer, alcohol and electrical fires. C-O-TWO is a non-conductor. It does not deteriorate.

**C-O-TWO is a registered trade mark. To be safe, specify C-O-TWO and this company's name when ordering.*

C-O-TWO FIRE EQUIPMENT CO.

NEWARK, NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada



How Sally used up a copper mine

LOOK at the picture carefully. See that elbow-rest under Sally's arm?

It is significant. In fact, it's a humble sermon on war production.

Understand the existence of that arm-rest and you understand one of the basic reasons why, in less than seven months after war-conversion, American industry is hollering for Washington to provide more copper and other basic raw materials.

► Before Sally got her arm-rest, she reached over to a box, picked up a tiny part for an airplane instrument and placed it in the machine . . . Now the supply box is tilted and constantly jiggled, so that the parts flow to her finger-tips. With each motion Sally saves a fraction of an ounce of energy and half a second of time.

Without such tiny savings of time and effort, America's 20,000,000 factory workers would be hopelessly handicapped in their race against the millions at work with a head-start of years in Germany, Japan and Italy.

► The muscle-misers and second-savers of our factories come in handy in this war, when splitting seconds in production is as important as it is in battle.

Who are the men that provide the arm-rests, jiggle the supply-boxes, conduct the ceaseless hunt for wasted half-seconds and needless human motion?

► They are the "methods" men of industry. They have all sorts of titles: plant managers, operations managers, methods engineers, efficiency engineers, etc. But their job is "to manage men and machines to save time and materials."

In peace, these men were the core of the industrial system that gave you the world's highest living standard at the world's lowest cost in hours of work.

► In war, these same "methods-managers," with the intelligent cooperation of American workmen, are cutting years from our arming task by splitting seconds from its millions of individual operations. This example of time-saving is just an indicator of what a plant operating man does. Such men have many other jobs, including the important job of plant maintenance, but "second-splitting" is the field in which they are the envy of the whole world.

The American Production Manager is the product of the American industrial system. Complex, loose-jointed and aimless though our system may seem to the theorist, it meets every challenge, because it is the best system ever devised by man for discovering, developing and rewarding individual initiative.

Reprints of this advertisement are available in handy booklet form.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET . . NEW YORK

SALLY—

IS UP YOUR ALLEY!

WASHINGTON, and other large city newspapers were used for the advertisement shown opposite, because government and public need to understand the asset which America has in its trained industrial staffs.

Read what we said about "methods management" in the advertisement, then ask yourself the secret of American genius for production economies in men, materials and time.

One big advantage we have in this country is the interchange of know-how between industries. If an instrument maker reduces a fourth-class hand motion to third-class, all other managers of small part assembly can, and do, find out how it was done.

By means of the articles and advertisements in FACTORY,* a plant operations magazine, tens of thousands of plant operating men keep abreast of each new development in equipment and technique.

The magazines of the McGraw-Hill Network of Industrial Communication exist solely for swapping ideas. They are backed by the editors and engineer-correspondents, who gather information wherever it is developed, and funnel it out to the fields where it is needed.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

* * *

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents... More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

*Factory Management & Maintenance—*SHOWS HOW TO MANAGE MEN AND MACHINES TO SAVE TIME AND MATERIALS*

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

ALSO AFFILIATED WITH BUSINESS PUBLISHERS INTERNATIONAL CORPORATION, PUBLISHERS OF BUSINESS AND TECHNICAL MAGAZINES FOR OVERSEAS CIRCULATION

★ BELL poles all go through a specially designed incising machine where the ground line area is subjected to a fibre spreading process so that maximum penetration with No. 1 A.W.P.A. creosote oil is assured. This is but one of the important steps in the preparation of BELL Long-Life Cedar Poles. Section of pole above shows even and full sapwood penetration.

BELL "*LONG-LIFE*"

CEDAR POLES

FULL LENGTH MACHINE SHAVED FULL LENGTH TREATED . . . .

Our two treating plants are equipped with the latest machinery. Included is a full length shaving machine used for reducing sapwood thickness to desired depth and producing an absolutely smooth pole from end to end. Thus prepared, the poles go into full length dipping tanks for full length treatment.

SELKIRK Range high altitude cedar, obtained from BELL-owned timber lands, gives you highest quality cedar. Specify BELL Long-Life Poles to cut pole costs, to reduce maintenance, to establish better public relations.

Write for a copy of our Cedar Pole Data Book and Pole Class Calculator.

** Buy United States Government "attack" bonds today for the sake of your dollars tomorrow*

BELL LUMBER & POLE CO.
Minneapolis, Minn.

BELL 1942 LBR. & POLE CO.

BELL
WESTERN RED CEDAR
NORTHERN WHITE

dent of the group for a number of years. Mr. Neal's term of office expires January, 1944 at which time Mr. Pickard, first vice-president, automatically assumes office.

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▶ J. O. SPEED, director of safety of the Alabama Power Co., has recently been elected chairman of the Alabama chapter, American Society of Safety Engineers.

▶ JOHN W. ANDERSON has been appointed assistant division superintendent, Philadelphia division, transmission and distribution department, Philadelphia Electric Co. Following graduation in 1920 from the University of Delaware as an electrical engineer, Mr. Anderson was employed by engineering firms in West Virginia and New York. After two years he joined the Philadelphia Electric organization as an assistant electrical designer and has been a member of that organization continuously since that time. He has had wide experience in electrical designing and construction work, having served during his employment with the Philadelphia utility as design calculator, senior electrical designer, engineer of system planning and superintendent of engineering division, transmission and distribution department.

▶ ERNEST KIPP, who has engaged in meter engineering for the Westinghouse Electric & Manufacturing Co. for many years, has joined the staff of the San Diego Gas & Electric Co., meter division, in the capacity of engineer.

▶ L. MICHELSON, electrical engineer of the Gleason Works, Rochester, N. Y., has been appointed a member of the sectional committee on industrial control apparatus of the American Standards Association.

▶ D. L. BEEMAN has been appointed engineer, industrial power section, succeeding E. G. MERRICK, and R. S. SAGE has been named engineer, mining section, succeeding F. L. STONE, according to an announcement by J. D. Wright, manager of General Electric's industrial engineering department. Mr. Merrick and Mr. Stone, both of whom have been associated with the company for many years, will continue in their respective sections with specially assigned duties and as engineering consultants. Mr. Wright also announced the transfer of petroleum industry application engineering responsibilities from the mining section to the chemical section headed by T. H. RHEA. This section will now be called the petroleum and chemical section. Mr. Beeman has been identified with General Electric since 1929 and for the

HIGH conductivity

LOW voltage drop

FARGO connectors

The "vise-like" grip of Fargo Connectors is the result of unique design and perfect machining of body and bolt.

The same careful machining results in high pressure contact between conductors and insures high conductivity with low voltage drop at the joint.

Another result of careful machining is the frequency with which Fargo Connectors may be reused over a long period of time.

Made by FARGO MFG. CO.
distributed by

LINE MATERIAL CO.
MILWAUKEE WISCONSIN

ALLOYS FOR THE ALLIES

WOLVERINE CONDENSER TUBES

These days, Wolverine is working 100% on war production—twenty-four hours a day, seven days a week. Of course, that's quite as it should be; and that's probably what you're doing, too.

Wolverine Condenser Tubes are on the job in many important installations—both land and sea.

Operators know that they can depend on Wolverine's high, uniform quality. As Wolverine is a division of Calumet and Hecla, this quality is now controlled from mining the original ore to turning out the finished product.

And every step in the manufacture of Wolverine Condenser Tubes is accompanied by constant, uncompromising testing and inspection. Condenser tubes must undergo many tests that are not necessary with other kinds of tube; and Wolverine has always been noted for the painstaking quality of its inspection and supervision.

So in these times and in the times to come, it will always be to your advantage to specify "Wolverine" for your condenser tube requirements.

WOLVERINE TUBE DIVISION

OF CALUMET AND HECLA CONSOLIDATED COPPER COMPANY

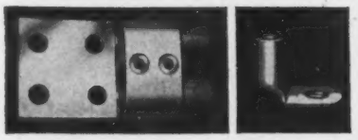
Seamless COPPER • BRASS

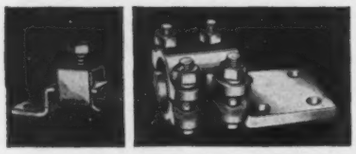
1427 CENTRAL AVENUE • DETROIT, MICHIGAN

"To get the **RIGHT** lug at every point—

—select your terminals from the **COMPLETE** line"

Look in the Penn-Union Catalog —all of the good types: Solderless lugs to grip the conductor by Bolt, Screw, Post-and-Nut, or Multi-Slit Tapered Sleeve . . . Soldering lugs, Cast and Stamped, in wide variety . . . Here are just a few:





You will also find the most complete line of Cable Taps, Tee Connectors . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Service Connectors.

Penn-Union fittings are preferred because every one is mechanically and electrically *dependable.* They are the first choice of leading utilities, industrials, electrical manufacturers, contractors. *Write for the Penn-Union Catalog.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

past year has been an application engineer in the industrial power section in Schenectady, specializing in industrial power distribution problems. In 1907 Mr. Sage joined G.E. at Schenectady as a student engineer on test. Since 1940 he has been an application engineer in the mining section.

▶ H. G. WINSOR has retired as personnel officer of the Puget Sound Power & Light Co., a position he has held since 1924. The utility loaned Mr. Winsor's services to the government, early last year, as Pacific Northwest representative of OPM's training-within-industry program and he moved up to his present position as district director of the War Manpower Commission last July. He entered the service of Puget Sound at Tacoma in 1913, after spending almost 30 years in the electrical industry in Massachusetts, Michigan and Minnesota. Mr. Winsor is relinquishing his position with the Puget Sound utility in order to devote full time to his duties with the Manpower Commission.

▶ DANIEL G. BOLLING has been named superintendent of the switchgear division of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, succeeding E. R. NARY, who has been appointed manager of manufacturing for the Westinghouse radio division in Baltimore. Mr. Bolling joined Westinghouse 30 years ago and served in various manufacturing supervisory positions in the switchgear division. CARL A. PICKERING has been named assistant superintendent of the division and placed in charge of switchboard devices and small De-ion circuit breakers. ROGER W. WARREN was appointed assistant superintendent in charge of Navy switchboards, metal-clad gear and large oil circuit breakers. Mr. Pickering has been identified with the company since 1920 and Mr. Warren since 1923.

▶ EDWIN H. BROWN, engineering vice-president of the Allis-Chalmers Manufacturing Co., has been appointed assistant chief of the WPB iron and steel branch in charge of the plant facilities section. He succeeds Don. N. Watkins, who has resigned to return to his position as president of Steel Publications, Inc. Mr. Brown's work will be in the "all-important task of guiding the construction and utilization of steel plant facilities," according to Hiland G. Batcheller, chief of the iron and steel branch. To enable him to assume his new wartime assignment Mr. Brown has been granted an indefinite leave of absence from the Milwaukee company. During his absence FORREST NAGLER, chief mechanical engineer, will be in charge of the Allis-Chalmers engineering and development department.

POLE INSURANCE THAT

Pay Dividends

Osmoplastic groundline treatment increases pole life 7 to 10 years

● Osmoplastic pole treatment is the finest insurance policy for guarding against groundline decay. Simple and easy to apply by your own men, the Osmoplastic treatment adds years to standing pole life thereby reducing costly replacements. It also lengthens the inspection cycle. Service records of over 60 leading utilities prove that Osmose groundline protection pays large dividends annually. Make inspection time Osmoplastic time for low cost pole protection.

OSMOSE WOOD PRESERVING CO.
Bailey Ave. Buffalo, N. Y.
CHICAGO, DENVER, DETROIT, NEW YORK

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

In May
In Sept
Materials—and Their Scarcity Ratings
A couple of months ago, the War Production Board issued its first report on the relative scarcity of industrial materials. WPB divided these into three groups, according to their availability for use in civilian production. In Group I and Group II are materials expected to be available—if at all—for only the most vital civilian needs. To replace these, manufacturers must draw on materials in Group III—but even some of these substitutes are growing tight.
How tight is shown by WPB's current report. Significantly, 12 materials in original report. Significantly, 12 mater
cotton duck, nylon, palm oil, quartz crysta
—have moved up from Group II to Grou
several materials have moved from Grou
II. Supplies of a very few materials—case
linseed oil, and sugar—have loosened
many newcomers on all three l
second report on scarcities:
Group I: Materials most vitally needed for war purposes; not generally available for civilian
Group II: Basic materials essential to the war industries but not as critically limited
Group III: Materials available in some quantities for other than strictly war
69
64
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89
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89
Business Week • May 2, 1942
24
Materials—and Their Scarcity Ratings
The latest revision of the War Production Board's report on the relative scarcity of raw materials (BW—May2'42, p24), demonstrates the growing tightness of the situation. Materials in Groups I and II are reserved largely for war use, will be available only for the most vital civilian necessities; while those in Group III are still sufficiently abundant in most cases to be used as substitutes. In general, this latest revision shows an increase in the number of items listed. Some materials such as atabrine, bismuth, celophane, iodine, and silver became tighter since the last list was published; others, such as borax, camphor, and lead, loosened up. Here is the latest revision of the list:
Group I: Materials of which the supplies are inadequate for war and most essential uses.
Group II: Essential materials, supplies of which are not so limited as those in Group I.
Group III: Materials of which the supplies are adequate for all appropriate types of present demands including use as substitutes.
Materials marked (*) are in the most critical category.
Business Week • September 5, 1942
War Business Checklist • 43

SCARCITIES continue to grow

• Each brings the problem of determining alternate materials —each brings the problem of fashioning them to provide service equal to the withdrawn materials—or to better it.

—up 30% in 4 months

In proving the value of new materials or alternate constructions ETL has helped many manufacturers to obviate delays in getting production under way. —in designing ingenious methods for pre-determining the effects of use and wear, ETL is helping manufacturers to uphold the service quality behind their brand names.

The pamphlet "Technical Services for Government Contracts" outlining such procedures, will be sent you on request.

Electrical Testing Laboratories, Inc.

HEADQUARTERS AND LABORATORIES
2 EAST END AVENUE AT 79TH STREET · NEW YORK
BUTTERFIELD 8-2600

EQUIPMENT: More than three thousand pieces of testing apparatus on inventory.

STAFF: More than 150, experienced in test procedure.

ELECTRICAL AND GENERAL TESTING · INSPECTIONS · RESEARCH CERTIFICATION

DURABLE, COMPACT T-CONNECTOR

O.Z.'s rugged, heavy duty connector is made of corrosion-resistant high copper alloy, assuring high electrical conductivity. It is simple, compact and easy to install — a single wrench does the job.

3333

O.Z. ELECTRICAL MFG. CO.

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REPRESENTATIVES IN PRINCIPAL CITIES

Typical southern pine poles, pressure-treated with PERMATOX A using 8 pounds per cubic foot.

"First Aid"

for old poles, cross-arms, posts, ties and timbers

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PERMATOX A

(5% pentachlorphenol solution in fuel oil)

is the effective preservative treatment to use on reclaimed stock for controlling decay and termite attack.

Poles can be treated in the lines by shaving off the rotted spots, and spraying all exposed surfaces thoroughly with PERMATOX *A*.

Or the poles can be removed, the tops and butts trimmed off, the decayed parts cut away, then the poles dipped or sprayed with PERMATOX *A* . . . a simple reclaiming process that solves the maintenance problem and adds years to service life.

PERMATOX *A* is low in cost and easily handled with standard equipment . . . and is rapidly increasing in use, both as straight "penta" solution alone, and in mixture with creosote.

Write for Bulletin and Specifications

A. D. CHAPMAN & COMPANY, INC.

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OBITUARY

▶ CHARLES E. CARPENTER, formerly sales manager of Cutler-Hammer, Inc., died in Poughkeepsie, N. Y., November 9, at the age of 78. Born at Big Falls, N. Y., in 1864, he attended Cornell University, graduating in 1888. He organized the Carpenter Enclosed Resistance Co. of Milwaukee, which pioneered a line of heating devices. In 1890 he invented the Carpenter enameled rheostat for controlling electric dynamos, motors and lights. The device was awarded a medal at the World's Fair in Chicago in 1893 and a gold medal at the Paris Exposition in 1900. He also invented the governor which enabled newspaper presses to inch at 1 percent of speed. Since retirement as sales manager and development engineer for Cutler-Hammer, Inc., he had lived in Poughkeepsie.

▶ DANIEL J. MCMAHON, 81, formerly superintendent of the Phillips Insulated Wire Co., Pawtucket, R. I., and of the Trenton (Mass.) Wire Works, died at Pawtucket on November 11.

▶ BENNET B. BRISTOL, who with his brother, Edgar H. Bristol, founded the Industrial Instrument Co., in 1908, which later became The Foxboro Co., died at his summer home at Falmouth Heights, Mass., on November 10, following several months' rest from a heart attack suffered last May. Mr. Bristol was born in Naugatuck, Conn., in 1868, and was graduated from the Stevens Institute of Technology in 1893. Throughout the history of The Foxboro Co. he served as its treasurer and clerk.

▶ ADDISON P. PARKER, 65, head of the personnel department of General Electric at Lynn, Mass., died suddenly on November 16. He had been with the company 48 years.

▶ JAMES A. O'NEIL, 58, for many years a designing engineer in the street lighting department of the River Works of General Electric at Lynn, Mass., died recently at his home in that city. He was a graduate of Worcester Polytechnic Institute and a member of the Thomson Quarter Century Club.

▶ PAUL R. JONES, director and secretary of Cities Service Co. since its inception, died on November 10, at New York Hospital, of pneumonia. Born in Cincinnati in 1876, he started with the Doherty organization in 1899 as a lamp boy for the Denver Electric Light Co. His first important work was when Mr. Doherty sent him to Lincoln, Neb., in 1900 to organize an accounting system. Subsequently he was in Lincoln for several years as secretary of the Lincoln Gas & Electric Co. When

SAVE HOURS OF WORK

ON DEFENSE JOBS WITH THESE GREENLEE TOOLS

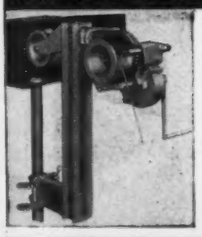
★ ★ ★ ★ ★

Cut labor costs and save vital hours on your defense jobs by turning to a better use of tools. Greenlee Tools are saving hundreds of contractors on defense jobs from 15 to 75% in time and labor costs by making the work easier and faster for the man on the job.

COMPLETE LINE OF BENDERS

For any bending job there's a Greenlee Bender. Small hand benders and powerful hydraulic benders for conduit, pipe and tubing from ½ to 4½-inch size. Benders that are easily operated by one man, save the cost of many manufactured bends and fittings, are compactly built in one unit, and are easily carried to the job and set up.

No. 765 CABLE PULLER



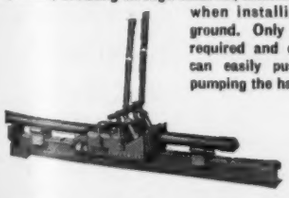
This handy Greenlee Cable Puller clamps right on to the conduit through which cable is pulled, is easily carried to the job, can be set up in a jiffy, and is easy for one man to operate with one or two cranks and will save many hours of work when pulling in cable.

KNOCKOUT TOOLS

Enlarge holes without long tedious drilling, reaming and filing with Greenlee Knockout Punches and Cutters. This handy tool is inserted in a knockout or a small drilled hole and a smooth accurate hole can be quickly cut by turning the drive nut with an ordinary wrench.

HYDRAULIC PIPE PUSHERS

Greenlee Pushers eliminate digging long trenches, tearing up lawns, breaking through concrete, backfilling, and tamping when installing pipe underground. Only a short trench is required and one or two men can easily push the pipe by pumping the handles.



WRITE FOR FREE COPY CATALOG 33E

Find out how these and other Greenlee Tools for the Electrician, Carpenter, and Plumber can help speed up your jobs . . . write for Catalog 33E.

GREENLEE TOOL CO.
1812 COLUMBIA AVE.
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Cities Service Co. was organized in New York in 1910 Mr. Jones became its first secretary, the position he held until his death. He also was chief auditor in charge of all accounting for the Cities Service organization. At the time of his death he was a director and secretary of Cities Service Power & Light Co., a director of Federal Light & Traction Co. and other corporations in the utility field.

► ALVA APPLE, for nineteen years superintendent of the Northern Indiana Power Co. at Sheridan, Ind., died recently in an Indianapolis hospital. He was 67 years old. Mr. Apple helped install the first light plant at Noblesville, Ind., and had been superintendent of plants there and also at Tipton and Lapel, Ind.

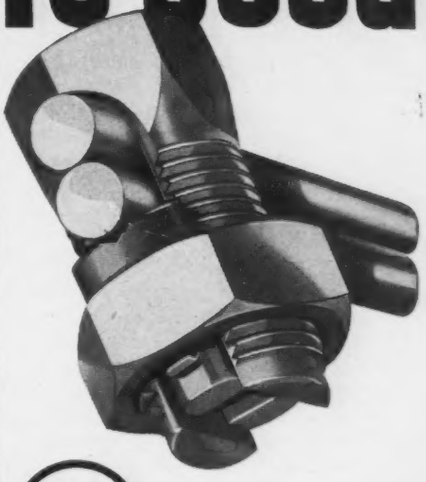
► CHESTER L. NESBITT, senior electrical engineer for the state of Pennsylvania, died, of pneumonia, at his home near Wilkes-Barre, on November 18, in his fifty-fourth year.

► ALFRED C. STRICKROTT, who had been connected with the New York Power & Light Corp. for approximately 40 years, died at his home in Schenectady on November 12, after several weeks' illness. In 1920, with the formation of the Adirondack Power & Light Corp., Mr. Strickrott was chosen superintendent of transportation. In 1921 he became editor of *The Synchronizer*, an employee magazine. Mr. Strickrott, who had been engaged in many publicity projects for the company, was associate editor of *The Niagara Hudson News*.

► JOHN J. KLEIN, assistant secretary of the Marmon-Herrington Co., died of pneumonia on November 11 at St. Vincent's Hospital, New York. Mr. Klein was born in New York City in 1910 and was graduated from the Stevens Institute of Technology and from the Fordham University School of Law. Previous to his appointment as assistant secretary of the Marmon-Herrington Co. he served in the capacity of assistant to A. W. Herrington, chairman of the board of directors, then president of the company.

► FREDERICK V. LINDSEY, vice-president and general sales manager of the Driver-Harris Co., Harrison, N. J., died in Memorial Hospital, New York, on November 17, after a brief illness. He was 64 years of age. Mr. Lindsey, who was born in Streator, Ill., resided in Chicago before going to Morristown, N. J., in 1916 to join the former Electrical Alloy Co. of Morristown, of which he become vice-president and general manager. In 1925 he joined the Driver-Harris company as vice-president and general manager when it absorbed the Electrical Alloy Company.

L-M Connectors can be re-used



Weather-immune material, plus carefully machine-cut threads on body and nut make L-M Connectors really re-usable.

Even after years of service, when the nut is loosened it can be easily run off by hand. Likewise, the nut is easily tightened when the connector is used again.

In the L-M Connector you get the highest re-usable torque of any split-bolt connector.

LINE MATERIAL CO.
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MANUFACTURING-MARKETS

Crocker-Wheeler Co. Plans Assets Sale

Crocker-Wheeler Electric Manufacturing Co. has entered into a contract with the Joshua Hendy Iron Works of Sunnyvale, Cal., for the sale of its assets, including its good will, for $3,200,000 in cash and the assumption by Hendy of all its liabilities. A special meeting of stockholders of Crocker-Wheeler has been called for December 10 for the purpose of acting upon the sale.

The agreement is signed by Edward E. Perot, president, and E. C. Jones, secretary, for Crocker-Wheeler, and by Charles E. Moore, president, and M. Levit, assistant secretary for Hendy.

In commenting on the plan Mr. Perot said in part:

"Officials of the Hendy company state that if the sale is consummated they intend to retain the management and employees of Crocker-Wheeler intact so that there will be no interruption whatsoever in the business. The combination of the two companies will in no way interfere with or retard the completion of Crocker-Wheeler's present unfilled orders. If the war continues, it is the purpose of the Hendy company to enlarge its plant capacity, both at the Ampere plant and the California plant. The Hendy Co. is also looking toward post-war activities. By combining and enlarging the lines of equipment manufactured by each company, the Hendy Co. expects to effect many economies and improvements in manufacture and to have a complete nation-wide sales organization."

As of September 30, 1942, Crocker-Wheeler had unfilled orders totaling $30,353,594. There are 290,500 no-par common shares outstanding.

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Cutler-Hammer Dividend

Cutler-Hammer, Inc., has voted a year-end dividend of 40 cents a common share, making total payments of $1.25 for this year, or 25 cents less than in 1941.

•

Belden Sets Shipping Record in October

Belden Manufacturing Co., Chicago, set a new record for shipments in October, Whipple Jacobs, president, has announced. October shipments this year were the largest in the history of the company. Total dollar volume for the month was $1,219,000, compared with the previous high monthly record of $1,130,000 in October, last year.

Belden is making electrical wiring and assemblies for warplanes, battleships, tanks, communications and other war uses.

TWENTY-YEAR EMBLEM—Harold B. Donley, merchandise sales manager of Westinghouse Electric Supply Co., is presented a 20-year service emblem by Walter Williamson, executive vice-president. Mr. Donley was hired as a sales clerk in 1922. In 1932 he was made manager of heating appliance sales and, in 1935, manager of the appliance department at Mansfield, Ohio. He has held his present position since 1941

Square D Reports $1,564,577 Net

For the nine months ended September 30, Square D Co. reports net profit of $2,189,577, after taxes of $6,303,594 but before provision of $625,000 for war and post-war reserves, which reduced the net profit to $1,564,577.

Profits for the first six months of the current year to June 30, were previously reported on the basis of tax rates as provided in the House bill. After adjustment of taxes to the law as finally passed, net profit for the first six months was $1,673,155, after taxes of $4,398,483 but before provision for war and post-war reserves which reduced the net profit to $1,548,155.

For the nine months ended September 30, 1941, the company reported a net profit of $2,255,876 after taxes of $4,410,775. Certain contracts for war materials may be subject to renegotiation and adjustment under provisions of the War Price Control Act, and due to the uncertainties involved, the effect, if any, of such Act upon the financial statements of the company cannot presently be determined, F. W. Magin, president of the company, stated in making the announcement.

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Simplex Wire Adds New Equipment

Simplex Wire & Cable Co., Cambridge, Mass., has enlarged its Latox department by the addition of eight new insulating machines built by the American Insulating Machinery Co., Philadelphia. Drying flues, fans and heaters had been installed to enable these units to go into service shortly after their arrival. Eight new spark and repair coilers manufactured by the Thomson-Judd Wire Machinery Co., Lynn, Mass., have been acquired, and Simplex has also received a five-conductor cabling

A BETTERMENT . . .

Not a Substitute

What manufacturer who has turned from slow, heavy riveting construction to modern, high-speed, light, dependable welding would want to turn back to riveting.

This development in production practice has crystallized so fast it might even be called a revolution.

Ship, tank, and other structural steel-makers, who yesterday were using riveting, are today staunch supporters of welding.

In almost as short a time Continental-Diamond NON-metallics have replaced many habitually used heavy—corrosive—costly materials. Likewise these new users of C-D NON-metallics will not want to go back to the replaced materials . . . even when they become plentiful. The reason . . . C-D NON-metallics are doing a better job—they have lightened weight, increased life, speeded up production, provided for the welfare and protection of workers.

There will be few who return to riveting and still fewer who will give up the "betterments" achieved when C-D NON-metallics are properly designed into their products.

The C-D booklet will give you basic data on FIVE C-D NON-metallics. When writing for it, ask for Booklet GF-12. Then, when you are ready to discuss your particular problem . . . write, wire or phone for a C-D Laboratory Research Representative.

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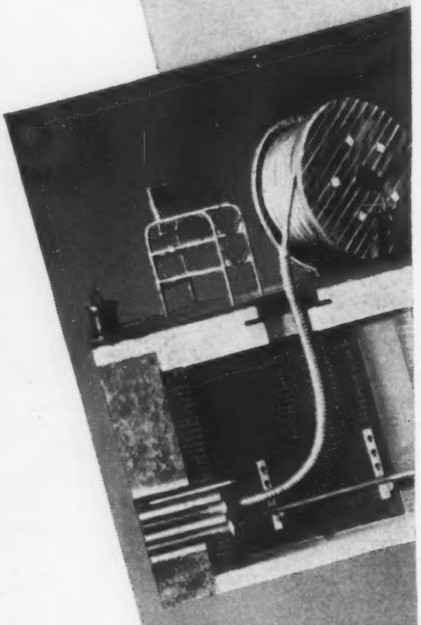

WRITE FOR CATALOG

T. J. COPE, INC.
6120-6122 VINE STREET
PHILADELPHIA, PA.

machine from the New England Butt Co., Providence, R. I., to be used in making up Latox cables. The testing department is being enlarged and new coilers added.

The company is giving serious study to the problem of utilizing women to maintain and increase production on jobs formerly handled by men now in the armed services. At present about 90 percent of the company's employees are buying U. S. War Savings Bonds and further increases in this supporting activity behind the fighting fronts are being sought.

•

Manufacturers Issue Earnings Reports

Among the manufacturing companies issuing earnings reports are the following:

SYLVANIA ELECTRIC PRODUCTS — Nine months to September 30, net income after $1,416,110 provision for Federal income taxes was $636,225, equal, after preferred dividend requirements, to $1.02 each on 514,368 common shares, against $837,759 or $1.41 a common share last year. Net sales, $21,626,283, against $14,752,540.

SUPERHEATER CO.—Including affiliated Canadian company, nine months to September 30, net profit, $865,116, equivalent to 97 cents a share, compared with $1,067,080, or $1.18 a share last year.

COPPERWELD STEEL—Nine months to September 30, net earnings, $873,336 after $1,037,509 income and excess profits taxes, but before restoration of prior years tax reserve of $362,753 and before a special charge of $233,503 for additional depreciation and obsolescence for 1941. This compares with net earnings of $1,224,093 for last year's period. After preferred dividend requirements, earnings for this year's period were equal to $1.54 a share on 514,864 common shares, against $2.21 a share last year.

GENERAL CABLE—Three months to September 30, net income after all expenses, taxes and other charges, $429,678, compared with $773,984 last year. Nine months to September 30, net income after all expenses and charges, $1,797,302, against net income of $2,829,207 in like period last year.

•

Foster Wheeler Plans $15,000,000 Credit

Foster Wheeler Corp. is arranging a $15,000,000 credit under regulation V through Manufacturers Trust Co. and is asking consent to the transaction from holders of its new prior preferred and old preferred stocks.

Purpose of the credit, John J. Brown, president, stated, is to provide working capital to finance the abnormal volume of business incident to war orders. The company's unfilled orders, he disclosed, are currently about ten times normal volume.

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Field Reports on Business

Electrical equipment requirements for industrial uses continue at high levels. No small amount of business is traceable to war camps, air fields and similar projects. The demand for electrical appliances far exceeds the supply. Water heaters are particularly active as the domestic fuel oil shortage grows.

NEW YORK

All the evidence points to a tough time for the retailer of consumer goods, including electrical appliances, in the near future. Retail failures may reach new highs next year, according to the Department of Commerce, and sales are expected to decline from 12 to 20 percent. Price Administrator Henderson is not easing the situation any with an announcement that some 4,000 retailers' licenses may be suspended because of alleged violations of the General Maximum Price Regulation.

The first quarterly reduction in inventories of manufacturers, wholesalers and retailers since 1939 took place in the third quarter of 1942, the Commerce Department reported last week. The declines were chiefly concentrated in consumer goods. Retailers' stocks were down more than $200,000,000, wholesalers' stocks $400,000,000, but industrial holdings were $240,000,000 higher at the end of September than at the end of June. The over-all decline in inventories, the report says, makes it evident that heavy buying power generated by wartime expansion is cutting into existing stocks to supplement the restricted volume of consumers goods now being produced.

Department store sales for the nation were up 13 percent for the week ended November 14, compared to the corresponding 1941 week, the Federal Reserve Board announced. New York's gain was only 4 percent, however.

Engineering construction volume for the week totaled $100,060,000, an increase of 56 percent over the corresponding 1941 week, but 67 percent below the near-record volume of the previous week, according to *Engineering News-Record.*

NEW ENGLAND

Interest in marine electrical equipment is active and in sharp contrast to the slackening demand in other fields of the electrical market. Machine tool builders are buying regularly, but in smaller lots than formerly; some industrial equipment business lies ahead among small firms who are engaged in supplying highly specialized and important war materials. One firm which spent about $20,000 in small motors, pumping units and control apparatus during the past summer plans to add about $10,000 worth of new equipment during the next quarter. Electric furnace and oven sales continue active in eastern Massachusetts. Recent commitments exceed 1,300 kw. in heat-treating applications besides 280 kw. in electric steam boiler units for degreasing and impregnating tank service, and 30 kw. in infra-red paint and photograph laboratory drying jobs.

Changes in some of the larger garages in Greater Boston areas for carrying on contract machining on war orders have resulted in orders for distribution transformers, panelboard apparatus and wiring supplies. The demand for incandescent lamps has fallen off in coastal areas despite a trend toward staying at home on account of the gas and tire shortage.

The demand for electrical merchandise far exceeds the supply in the larger appliance field. Ranges are moving in war plant housing areas, however. Water heaters are active as the domestic fuel oil supply shortage grows, but these are difficult to obtain. The market is almost denuded of 600-watt air-heaters and one dealer said last week that he could sell 1,000 such units in a day, if available, to supplement usual methods of home heating.

PACIFIC COAST

Major electrical appliance sales for the first three quarters of 1942 for northern California, a typical area, reveal decreases from corresponding 1941 sales of 55 percent for water heaters, 65 percent for washers, 74 percent for ranges and 87 percent for refrigerators; repair programs are somewhat hampered by lack of experienced labor; building permit values for seven Western states for October total $18,547,140, a decrease of 60 percent from October, 1941, total of $46,470,596; 150,000 kw. of Shasta power will be available by January, 1944, a cut from the 450,000 kw. originally planned. However, Keswick Dam construction has been reprieved from the priority withdrawal recently ordered.

Industrial developments include U. S. Maritime awards totaling $15,000,000 to Everett and Longview firms; a $1,500,000 tin recovery plant for Los Angeles area; additions to Bethlehem Steel's East Bay shipyard; VEGA aircraft expansion at Burbank and new buildings and ways for Western Pipe & Steel in south San Francisco.

Recent awards include $43,780 for heat insulation of Los Angeles Harbor steam plant; $10,394 to General Electric, $14,853 to Allis-Chalmers, and $7,140 to Westinghouse, all covering instrument transformers for Colfax and Ampere stations of Bonneville system.

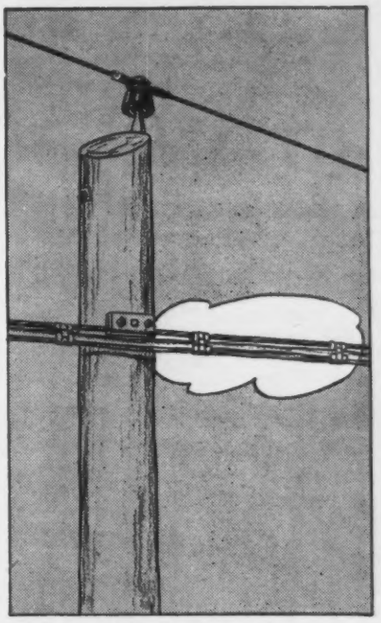
CHICAGO

Despite a decline in new orders during recent weeks the demand for a wide variety of electrical equipment for industrial uses continues at high levels. Government requirements account for a sizable amount, but the greatest demand comes from industrial sources for construction and maintenance equipment. War housing projects are increasing and will partially offset the loss of residential building.

Sparta Creamery Association in Wisconsin will expand its facilities at a cost of $314,635 with equipment including fans and motors, control apparatus, transformers and three-tube fluorescent lighting fixtures. Super Electric Construction Co. was awarded a contract for a night lighting system in war department buildings in Calhoun County, Michigan. An estimated $2,000,000 will be spent by the Navy department for motors, control equipment and other machinery for bridge alterations over the drainage canal. A large hotel will be converted to an army hospital at a cost of $400,000, including a sizable amount for X-ray equipment and lighting fixtures.

Holiday buying has started with a rush and retail sales are recording sharp increases. The demand for appliances is heavy and shortages are daily becoming more apparent.

Reduce Outages
Avoid Cable Wear
Reduce Maintenance



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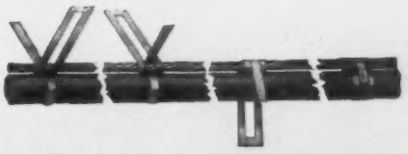

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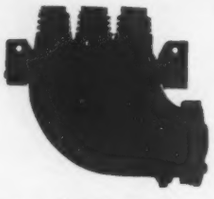

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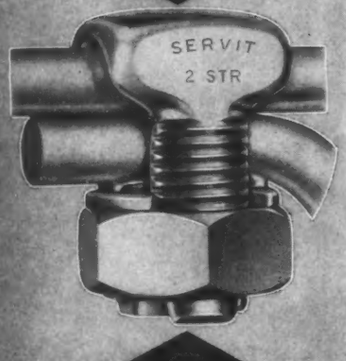

WILL SPEED UP
YOUR HOOK-UP

BURNDY 107 EASTERN BLVD. NEW YORK CITY

Sales Opportunities

MICHIGAN—Detroit Edison Co., Detroit, has contracted with local U. S. District Engineer Office for construction of new 24,000-volt transmission line. Work is scheduled to begin soon.

CALIFORNIA—War Department has authorized new air force base. Electrical equipment will be installed, including power substation, with underground and overhead distribution lines for airfield, industrial and residential service. Entire project will cost over $2,000,000 and will be supervised by U. S. District Engineer Office, Sacramento.

WASHINGTON—Civil Aeronautics Administration, Washington, D. C., and Boeing Field, Seattle, plans expansion in airport, including lighting facilities. Appropriation of $450,000 has been authorized.

ALABAMA — Bechtel - McCone - Parsons Corp., 601 West Fifth Street, Los Angeles, Calif., engineer and contractor, has contracted with government for construction and operation of new aircraft plant, with main unit 700x1,600 ft. Power substation facilities will be installed. Cost estimated at $12,500,000, with financing by Defense Plant Corp. Work will be carried out soon.

WISCONSIN—Wisconsin Electric Power Co., Milwaukee, has asked bids for construction of addition to indoor power substation, exclusive of equipment, and will make award in near future.

LOUISIANA—Southwestern Gas & Electric Co., Shreveport, has plans for intake crib. Application has been made for federal permission and work is scheduled to begin soon.

MICHIGAN—War Department has authorized new air force base. Electrical equipment will be installed, including power substation, with underground and overhead distribution lines for airfield, industrial and residential service. Entire project will cost over $2,000,000 and will be supervised by U. S. District Engineer Office, Detroit.

WYOMING—Frontier Refining Co., Cheyenne, has completed plans for oil refinery for production of 100-octane gasoline for aviation service for government. It will comprise several large processing and production units, with facilities for handling 3,500 barrels of crude oil daily. Cost close to $4,000,000, with financing by Defense Plant Corp.

TENNESSEE—U. S. District Engineer Office, Nashville, plans new army group hospital, with complete electrical facilities, including power substation. Cost estimated over $3,000,000.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has approved plans for expansion in naval air station at military site. Additional electrical facilities will be installed, including power substation and distribution system. Cost estimated about $3,500,000. Work will begin at once.

LOUISIANA—Higgins Industries, Inc., 521 City Park Ave., New Orleans, will have plans prepared by Albert Kahn Associated Architects & Engineers, Inc., New Center Bldg., Detroit, Mich., architect and engineer, for proposed new aircraft plant for production of cargo-type planes for government. Electrical equipment will be installed. Initial works will cost over $600,000, with financing by Defense Plant Corp. Company has organized new subsidiary under name of Higgins Aircraft, Inc., to operate plant.

MISSOURI—Kansas City Power & Light Co., Kansas City, has approved plans for expansion in indoor-type power substation, with installation to include transformers, switchgear, etc. Work is scheduled to begin at once.

OHIO—Cleveland Electric Illuminating Co., Cleveland, has let building contract, exclusive of equipment, for new power substation to Hunkin-Conkey Construction Co., 1740 East 12th St., and will begin work at once. Cost about $200,000, with equipment and line extensions.

SOUTH CAROLINA—War Department has authorized immediate construction of new air force base. Complete electrical equipment will be installed, including power substation and distribution lines for airfield, industrial and residential service. Entire development will cost over $2,000,000 and will be supervised by U. S. District Engineer Office, Charleston.

OHIO—Goodyear Aircraft Corp., Akron, a subsidiary of Goodyear Tire & Rubber Co., same address, plans expansion in plants for production of airplane parts for government. Cost over $900,000 for machinery and electrical equipment. Financing by Defense Plant Corp.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has approved plans for new marine corps training base. Electrical facilities will be installed, including power substation and distribution system. Cost close to $9,680,000. Work will begin at once.

TEXAS—U. S. District Engineer Office, Denison, has instructed C. F. Lytle Co., Sioux City, Iowa, general contractor, to proceed with construction of hydroelectric generating station, comprising last major phase of project. Cost of plant estimated at $2,401,000. Equipment purchases are being made separately.

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Increases DPC Contract

An increase in its contract with Nash-Kelvinator Corp., Detroit, for additional plant facilities in Wisconsin has been announced by Defense Plant Corporation. The increase will be in excess of $900,000, making a total commitment in excess of $32,000,000. Nash-Kelvinator will operate these facilities and title will remain in Defense Plant.

•

Set "New Idea" Record

War-conscious General Electric workers this year have shattered all company records for worth-while suggestions, William E. Owen, of the company suggestion system, has announced. During the first ten months of 1942, he disclosed, G.E. employees were paid $115,000 for 12,250 ideas for saving materials or time in war production. This surpasses by a wide margin the best previous annual mark, $104,000 paid for all suggestions adopted in the full year of 1929.

LETTERS TO THE EDITOR

Lightning Arresters for Rural Meters

To the Editor of ELECTRICAL WORLD:

In your October 3, 1942, issue there is published an article by F. B. Scott, "Meter Failures Guide REA to Correctives."

Among the factors influencing meter failures, No. 4 on page 1986 states: "The use of secondary lightning arresters is not justified in many cases because, unless the ground resistance is low they do not operate effectively, and when the ground resistance is low they are not needed." It is regrettable that the article does not include the data from which the conclusion was drawn that the arresters are not effective if the ground resistance is high, together with information on how the arresters were applied and where located.

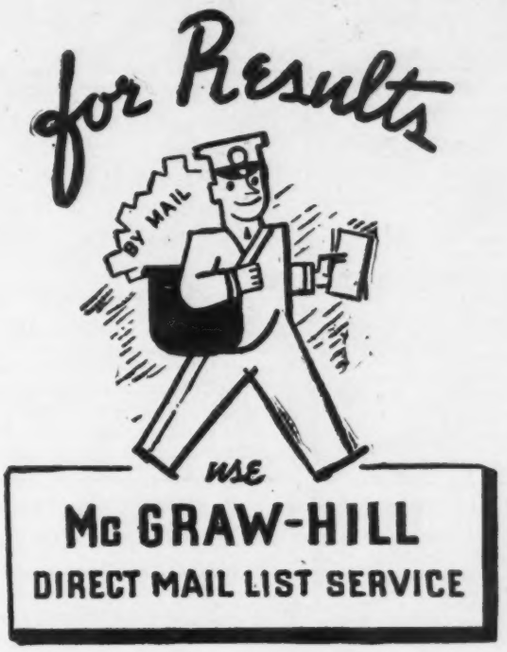
If it is a fact that lightning damage to meters is highest in regions of high earth resistivity, it seems to the writer that it is in the latter region that arresters might be expected to be most effective in preventing lightning damage to meters, if properly applied. This means not only choice of adequate arresters but application at the meter, and grounding to the neutral wire. Mention of this has been made in an article by A. M. Opsahl, "Lightning Protection of Domestic Watt-Hour Meters," in the *Westinghouse Engineer*, May, 1942.

The REA is in an enviable position to accumulate country-wide field experience data of benefit to the industry and more detailed information on the conclusion drawn regarding lightning protection for meters would be of considerable interest.

EDWARD BECK, Section Engineer
Switchgear Engineering Department,
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

I have read the comments by Mr. Beck of the Westinghouse company on my article in the October 3 issue of ELECTRICAL WORLD and wish to add that similar comments were received from Mr. Towne and Mr. MacCarthy of General Electric.

My statement that the lightning arresters are not effective when the ground resistance is high is based on the fact that a dangerously high potential will be impressed on the consumer's metering equipment and appliances which happen to be in use at the time of the lightning surge. While the arrester will equalize the potentials be-



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tween parts of the meter or appliances and thereby prevent damage to them, there is a danger of electric shock to persons in contact with consumers' appliances. There is also the possibility of grounding conditions being much better at the place where the appliance is being used than at the ground connection for the lightning arrester, for example, with electric washing machines. I agree with Mr. Beck and others that the lightning arrester will act as an equipment protector, but maintain that it will not perform its primary function, namely, to dissipate the lightning surge to ground without building up objectionable voltages on the secondary equipment and appliances when ground resistances are high. In this connection I might add that the arresters of the manufacturers mentioned are sold under the name of protectors instead of arresters.

F. B. Scott, Head
Testing and Metering Unit
Technical Standards Division, REA.

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Wiring Restrictions

To the Editor of Electrical World:

Your editorial "War Removes Restrictions on Wiring Program," in the October 31 issue of Electrical World, is to be commended as timely, patriotic and sensible. Many engineers hope that one useful result of this war will be the establishment of construction codes on an engineering performance basis rather than on the arbitrary trade barrier basis, which apparently has partly determined the detailed requirements of some codes.

Your suggestion of keeping accurate records of all installations using new methods, if followed, would undoubtedly result in the accumulation of much data justifying the new methods. The problem will be to obtain accurate and complete records. Possibly you have heard that the Mechanical Engineering Building, which was constructed at the university about 1928, uses the conduit-return system for branch circuits. Professor Bennett, who persuaded the Industrial Commission to permit this trial installation, has had a survey made of the conduit resistance twice since, I believe, and could furnish a good report on this installation.

Royce E. Johnson, Director,
Electrical Standards Laboratory,
University of Wisconsin, Madison

[The conduit-return system mentioned by Professor Johnson was described at the time in Electrical World, September 7, 1929, page 461, and September 14, 1929, page 527. We are now arranging to publish experience data as suggested. This should appear in an early issue.—Editors.]

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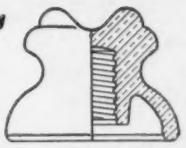

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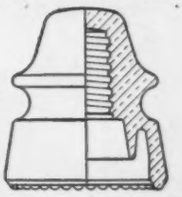

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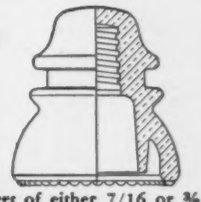

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